Construction Methods and Equipment

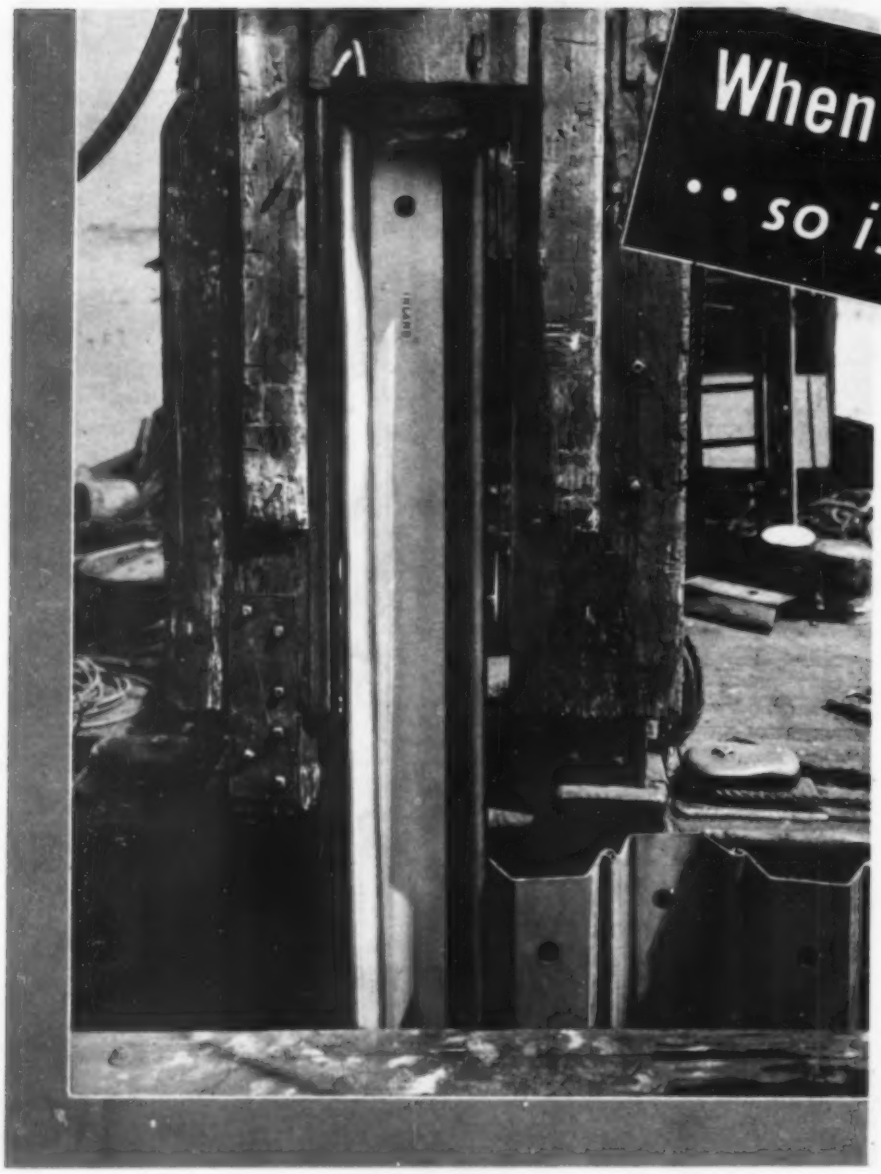
McGraw-Hill Publishing Company, Inc.

February, 1937

Price 20 Cents

BOTTOM DRILLING on foundation for Bonneville Dam on Columbia River in Washington.

IN THIS ISSUE: Plant Layout at Bonneville Dam . . . Winter Concreting of Thin-Arch Industrial Roof . . . Stone-Faced Arch Bridge . . . Storm Sewer in Old Canal Bed . . . Aluminum Street Flusher . . . Material Handling Plant for Paving Job . . . Concreting Shaft With Revolving Chute Rig.



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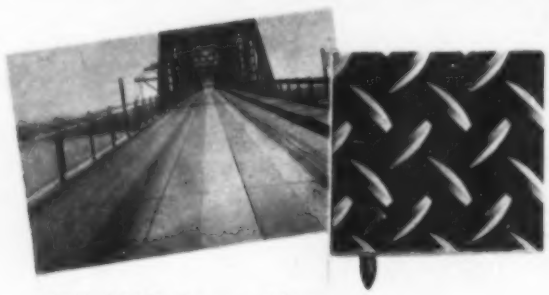

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CURRENT JOBS

...and Who's Doing Them

Buildings

Public — Apex building, Washington, D. C., will be constructed by **McCloskey & Co.**, Philadelphia, under Treasury Department contract for $3,105,000. At Tuscon, Ariz., **J. J. Garfield Building Co.,** is starting dormitory on University of Arizona campus, awarded for $233,000. Exposition buildings at San Francisco are to be erected by **G. F. Atkinson Co.,** San Francisco, for $1,181,544. **R. S. Ball Construction Co.,** Fort Worth, Tex., offered low bid of $846,000 for hospital at Fort Defiance, Ariz. At Syracuse, N. Y., **Millimet Construction Co.,** of New York City, presented low bid of $500,000 for horticultural building at state fairgrounds. General contract for Houston, Tex., convention hall went to **Knutson Construction Co.,** Houston, for $827,000. Construction of asphalt plant, Borough of Queens, was awarded to **Woodcrest Construction Co.,** New York City, at $598,626. Library building, Washington, D. C., is to be built by **Irwin & Leighton,** Philadelphia, under Interior Department contract for $817,225.

Industrial—Concrete work was awarded to **A. R. Rogers,** Panama City, Fla., for paper mill estimated to exceed $8,000,000 being built at Georgetown, S.C., by Southern Kraft Corp. New plant estimated to exceed $450,000 is to be built for Cleveland Twist Drill Co., by **S. W. Emerson Co.,** Cleveland, Ohio. Plant additions valued at $600,000 are to be made for American Cyanamid Co., at Valdosta, Ga., by **Fiske-Carter Construction Co.,** Spartanburg, S. C. **A. W. Neumann Co.,** of Des Moines, Iowa, will build $400,000 plant there for Iowa Packing Co. Mill estimated to cost $3,000,000 at Fernandina, Fla., for Container Corp. of America, and mill addition valued at $3,000,000 at Savannah, Ga., for Union Bag & Paper Co., are to be built by **Merritt-Chapman & Scott Corp.,** New York City. At Hartford, Conn., Hartford Electric Light Co. awarded contract for $3,250,000 power plant extension to **Stone & Webster Engineering Corp.,** Boston, Mass. **Rust Engineering Co.,** Pittsburgh, Pa., received contract for $3,500,000 pulp and board mill at Franklin, Va., from Chesapeake Camp Corp. Indianapolis Railways, Inc., awarded $521,900 contract for bus storage and service building, Indianapolis, Ind., to **Lundhoff-Bicknell Co.,** Chicago.

Commercial — Brooklyn theater estimated to cost $500,000 is to be built by **Herman Weingarten & P. Greenbaum,** of Brooklyn, N. Y. At Los Angeles, **William Simpson Construction Co.,** Los Angeles, is erecting $750,000 group of radio station buildings for Columbia Broadcasting System. Southern New England Telephone Co. has selected **Dwight Building Co.,** of New Haven, Conn., to construct $2,000,000 office building in New Haven.

Highways

State highway departments have awarded contracts as follows: Alabama, 16.7 mi. double bituminous surface treatment, Elmore County, to **Vandigriff Construction Co.,** Montgomery, Ala., $195,731. Colorado, 2 mi. concrete paving northerly from Denver city limits, to **Western Paving & Construction Co.,** Denver, $235,418. Florida, 14.7 mi. grading and bridge, Broward County, to **Badgett Construction Co.,** Ocala, Fla., $318,934. Indiana, paving 6.1 mi., Wells and Allen Counties, $218,608; 6 mi., Wells County, $219,841; 4.8 mi., Madison and Delaware Counties, $105,689; all three to **D. M. Vaughan,** Lafayette, Ind. Iowa, concrete paving, Sioux County, to **Western Asphalt Paving Corp.,** Sioux City, $236,146. Mississippi, 9 mi. grading, drainage, bridges, alternate types paving, Neshoba County, to **Hardaway Contracting Co.,** Columbus, Ga., $218,538. New York, improving 6.7 mi., Chautauqua County, to **P. Knickenberg,** Buffalo, N. Y., $312,073; 6.6 mi., Wayne County, to **Warren Bros. Roads Co.,** Cambridge, Mass., $252,618. North Carolina, 11.7 mi. concrete paving, Wake and Durham Counties, to **Simmons-Mayrant Co.,** Charleston, S. C., $259,686. Pennsylvania, 1.4 mi. dual type paving, highway overpass and two reinforced-concrete structures, Cumberland and Perry Counties, to **Roberts Paving Co.,** Salisbury, Md., $456,915. Texas, 16 mi. concrete paving, Collingsworth County, to **Texas Bitulithic Co.,** Dallas, Tex., $310,263; 13.9 mi. concrete paving, Sabine County, to **Harrison Engineering & Construction Co.,** Kansas City, Mo., $297,585.

Dredging

Contract for dredging and disposing of 2,169,000 cu.yd. from Lake Calumet, Ill., was awarded to **Johnson Construction Co.** and **La Crosse Dredging Co.,** Chicago, for $328,744. In Sabine Pass, Tex., **Standard Dredging Co.,** New York City, will dredge 4,010,000 cu.yd. for $319,597.

Construction Methods and Equipment

ROBERT K. TOMLIN, Editor — **FEBRUARY, 1937** — WILLARD CHEVALIER, Vice-President

Editorial Staff: Vincent B. Smith, John B. Huttl (San Francisco), Paul Wooton (Washington), Nelle Fitzgerald

The "How" of it:

For the benefit of readers concerned with the practical application of method or equipment the following references are to articles or illustrations in this issue that tell:

CURRENT JOBS

..and Who's Doing Them

Waterworks

San Francisco, Calif., water supply pipe line has been awarded to **Williams Bros. & Haas, Inc.,** San Francisco, for $643,939. At St. Maries, Idaho, city awarded $102,228 contract for pipe line and stone masonry dam to **E. K. Ferguson Sons Co.,** Spanish Fork, Idaho. For City of Everett, Wash., **Western Pipe & Steel Co.,** San Francisco, will build 20-mi. main under $1,257,366 contract. Talco, Tex., has entered into contract with **O. L. Crigler,** Kilgore, Tex., to construct complete waterworks, distributing system and sewerage system.

Sewers

Tunnel in sewage treatment works system will be constructed by **Broderick & Gordon,** Denver, Colo., for City and County of Denver under contract valued at $555,440. At Buffalo, N. Y., contract of $1,713,572 for pumping station, grit chamber and four sedimentation tanks has been awarded to **Bryant & Detwiler Co.,** Detroit, Mich. Low bids on two sections of interceptor in Detroit, Mich., have been received from **Nolan Construction Co.,** Detroit, $557,565 and from **Drainage Contractors, Inc.,** Detroit, $569,800.

Bridges

Structure crossing Delaware River at Easton, Pa. was awarded to **Bethlehem Steel Co.,** Philadelphia, for $722,746. Railroad deck on St. Louis, Mo., Municipal Bridge across Mississippi River went to **List Construction Co.,** Kansas City, Mo., for $206,110. At Cairo, Ill., substructure contract for Ohio River bridge was awarded to **Missouri Valley Bridge & Iron Co.,** Leavenworth, Kan., $621,572; superstructure, to **Mt. Vernon Bridge Co.,** Mt. Vernon, Ohio, $979,751. In New York City, **P. T. Cox Contracting Co.,** New York City, received contract for railroad grade separation, $179,720. At Depew, N. Y., **Foley Bros., Inc.,** New York City, will build railroad grade separation estimated to cost $500,000. **Murphy & Richman,** New York City, will reconstruct city bridges under $184,172 contract. Red River bridge, Bonham, Tex., has been awarded to **Kansas City Bridge Co.,** Kansas City, Mo., $335,510. Five bridges in Muncie, Ind., will be built by **Midwest Construction Co.,** Chicago, under contracts aggregating $553,521. Railroad grade separation estimated at $1,470,000, Little Falls, N. Y., was awarded to **Bates & Rogers,** Chicago. At Norwalk, Conn., bridge contract went to **D. Deering Co.,** Norwalk, for $479,939.

Miscellaneous

Low bid for Dam 3, Mississippi River, estimated at $3,000,000, was received from **A. Guthrie & Co.,** St. Paul, Minn. At Brownsville, Tex., **Dodds & Wedegartner,** San Benito, Tex., will build wharf and shed under $245,848 contract. In New York City, cast-iron lining for Queens-Midtown tunnel was awarded to **United States Pipe & Foundry Co.,** Burlington, N. J., for $3,356,001; iron and cast-steel lining, Midtown Hudson tunnel, to **Bethlehem Steel Co.,** New York City, $3,080,252. In Northwest states, Minnesota to Washington, **Great Northern Ry.,** St. Paul, Minn., will spend $10,000,000 or more, day labor and separate contracts, for maintenance and improvements.

CONSTRUCTION—
IV—A Dispersed Industry

IN MOST of the talk about industrial problems there prevails a misleading tendency to generalize. We talk too much about "industry" in the abstract. Industry, of course, does not exist in the abstract; each industry is a concrete entity; its problems can be handled constructively only as we see them concretely for what they are. This is important not only in dealing with the overhead matters that naturally concern us during a period of economic readjustment but also in the everyday internal operations of the industry.

During recent months this page has discussed some of the distinctive features of construction practice in the hope that it might help the industry, those who do business with it and those who would coordinate its activities to carry on more effectively.

This month it would focus on one factor that touches intimately every phase of construction activity. In a word: construction is a *dispersed* industry. That is to say, it is composed not of a relatively small number of large producing units but of a very large number of relatively small units.

THIS CONDITION appears to be inherent in the operation of the industry. As has already been indicated in this series, each construction project must be handled as a unit. The aggregate construction volume of the country, vast though it may be, consists of an enormous number of individual projects dispersed throughout the land. Unlike a manufacturing industry, construction cannot assemble in one place any substantial share of the construction activities of the nation. It cannot concentrate its productive activities and ship its products to the point of use.

This is almost as true of the planning and designing functions as it is of construction itself. Each separate project must assemble, even at its inception, the necessary architectural, engineering and other creative talent and then seek out a constructor who will translate their designs into reality.

It is true that many large projects may be handled under one governmental bureau or by a far-flung utility organization; it is true, also, that we have been hearing of fabricated houses that will permit factory production and shipment to the point of erection. But these are but the exceptions that test the rule, they are of limited scope and, even with them, the independent field organization probably always will be essential to the conduct of construction operations.

ALL THIS means that efforts to organize the construction industry, whether under private or public auspices, are unlikely to succeed under a scheme or structure that might be quite practical with more highly integrated industries. It means also that if the construction industry is to deal effectively with its internal problems and present a united front in dealing with its external problems, it must learn through cooperation to compensate for the weaknesses of dispersion. It means that everyone who would do business with the rich construction market must take thoroughly into account its widespread scope and manifold buying factors; to win general acceptance and consistent use for his product or service he must maintain the most continuous possible contact with a vast army of independent architects, engineers and constructors, any of whom may be associated at any time under any one of several relationships with any one or more of a vast number of owners.

In its dispersed structure construction resembles agriculture much more closely than it does manufacturing with the additional complication of these diversified functions and their mobility, already discussed in this series.

Natural consequences of this dispersion, with its premium on the relatively small, independent and mobile operator, are certain conditions that govern competition and freedom of enterprise; these have a marked influence on the welfare of the industry and the community. But they must be dealt with in a future issue. For the moment, the point is merely that construction is not a right, tight, centralized industry; the chances are that it must remain for the most part a far-flung, widely dispersed and incoherent group of highly individual operators.

Willard Chevalier

CONSTRUCTION Methods and Equipment, February 1937, Volume 19, Number 2. Published Monthly, price 20¢ a copy. Subscription rates—United States, Canada, Mexico and Central and South American countries, $2.00 a year. All other countries, $4.00 a year or 16 shillings. Entered (or reentered) as second class matter December 16, 1936 at the Post Office at New York, N.Y., under the act of March 3rd, 1879. Printed in U.S.A. Cable address "McGrawhill, New York." Member of A.B.P. Member of A.B.C.

McGRAW-HILL PUBLISHING COMPANY, INC., 330 WEST 42d STREET, NEW YORK, N. Y.

Editorial and Publishing Offices: 330 West 42nd St., New York; 520 North Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, London, W. C. 2, England.
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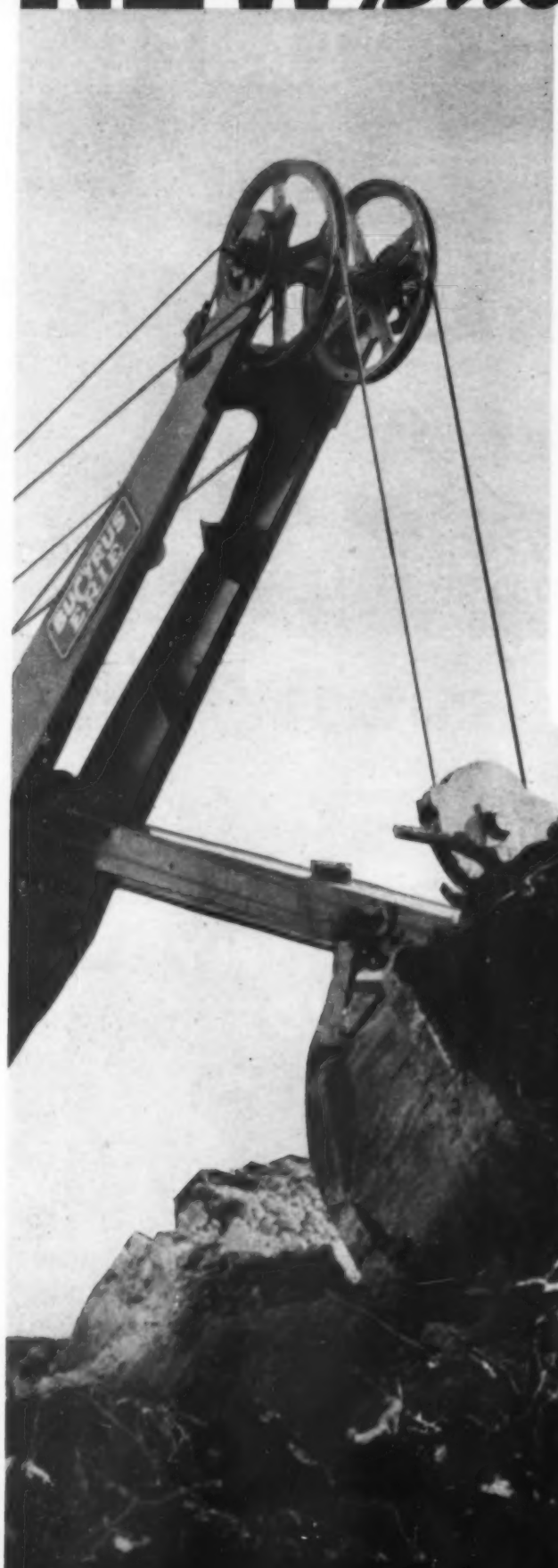

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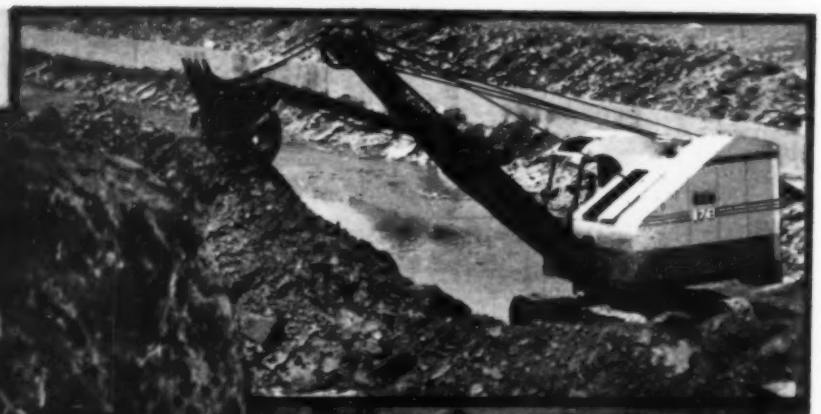

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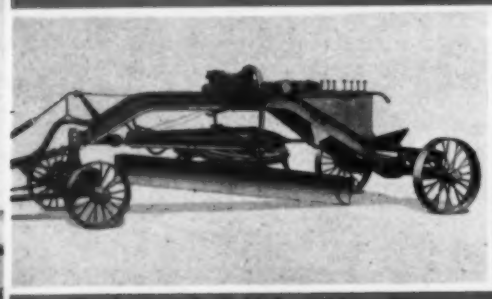
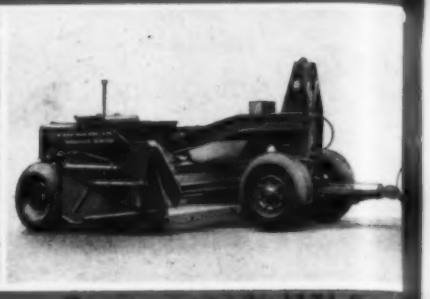
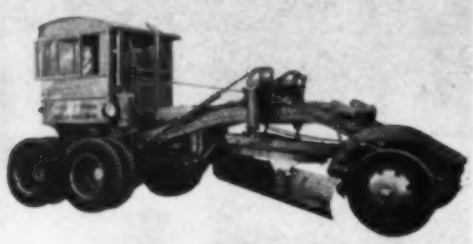


The luxury of all blade guidance. One-piece welded frame; direct draft from tractor hitch to blade, plus hydraulic controls.



One man operates this 12-Yd. Scraper from tractor. Won't stall on the dump. Attach or detach from tractor in 30 seconds. Hydraulic controls.



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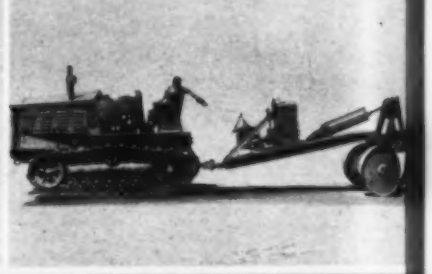

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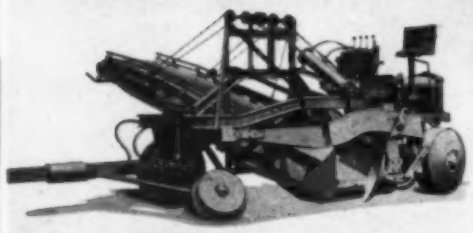

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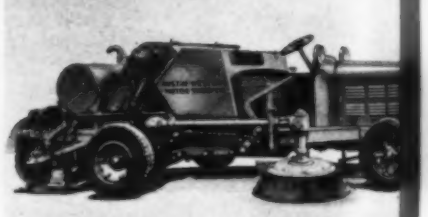

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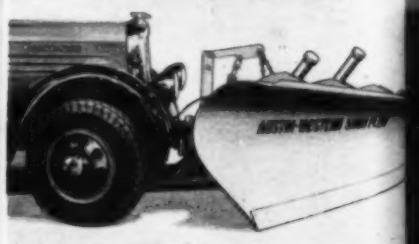

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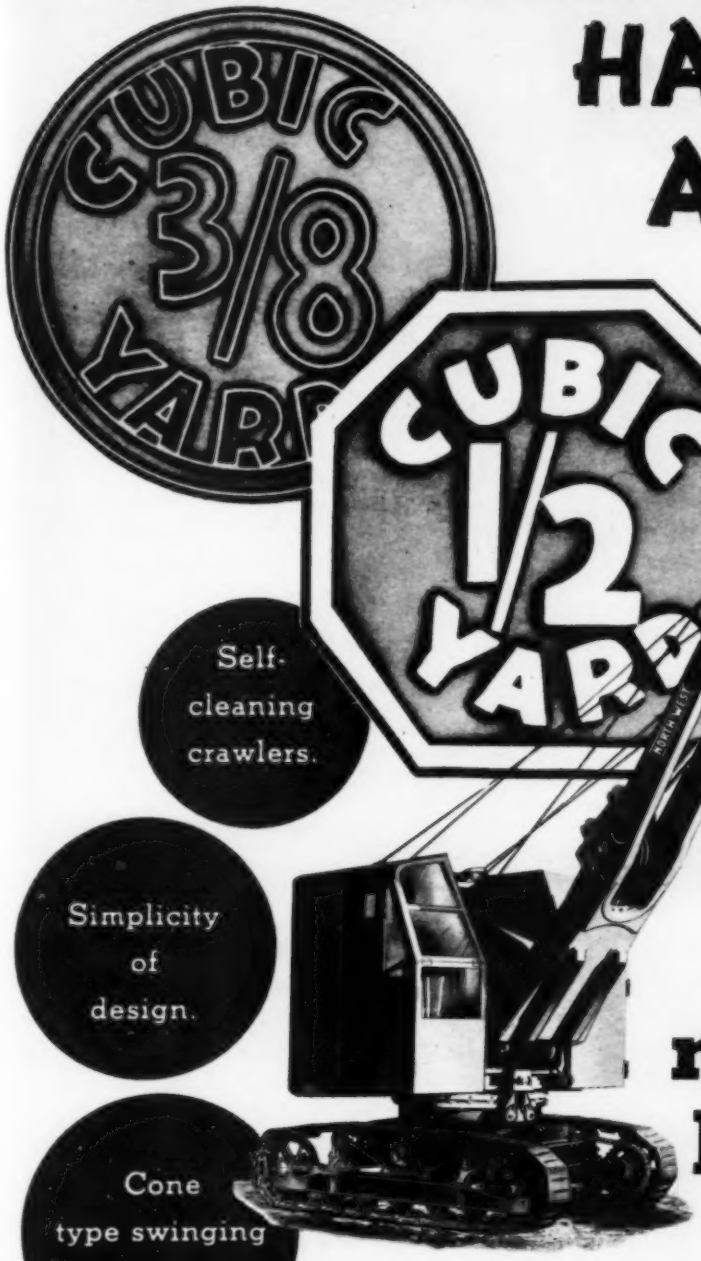

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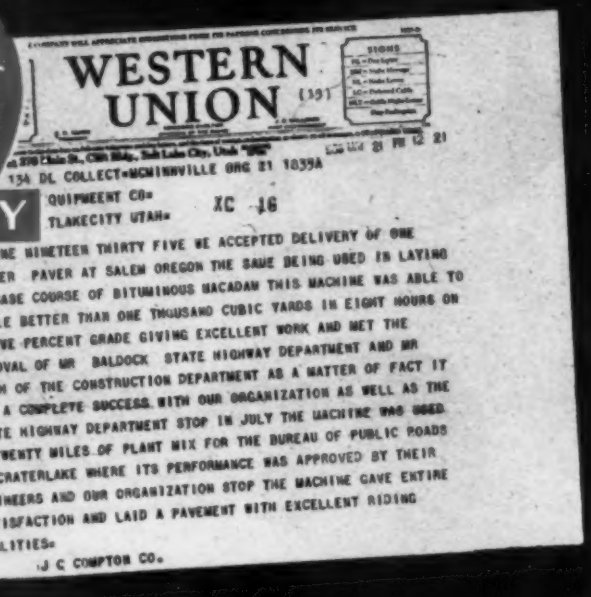

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QUIPMEENT CO=
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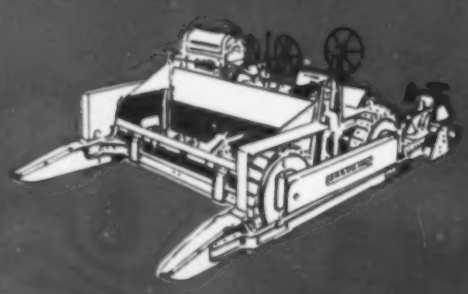
IN JUNE NINETEEN THIRTY FIVE WE ACCEPTED DELIVERY OF ONE JAEGER PAVER AT SALEM OREGON THE SAME BEING USED IN LAYING THE BASE COURSE OF BITUMINOUS MACADAM THIS MACHINE WAS ABLE TO HANDLE BETTER THAN ONE THOUSAND CUBIC YARDS IN EIGHT HOURS ON A FIVE PERCENT GRADE GIVING EXCELLENT WORK AND MET THE APPROVAL OF MR BALDOCK STATE HIGHWAY DEPARTMENT AND MR SMITH OF THE CONSTRUCTION DEPARTMENT AS A MATTER OF FACT IT WAS A COMPLETE SUCCESS WITH OUR ORGANIZATION AS WELL AS THE STATE HIGHWAY DEPARTMENT STOP IN JULY THE MACHINE WAS USED ON TWENTY MILES OF PLANT MIX FOR THE BUREAU OF PUBLIC ROADS AT CRATERLAKE WHERE ITS PERFORMANCE WAS APPROVED BY THEIR ENGINEERS AND OUR ORGANIZATION STOP THE MACHINE GAVE ENTIRE SATISFACTION AND LAID A PAVEMENT WITH EXCELLENT RIDING QUALITIES=

J C COMPTON CO=

JAEGER *Bituminous* PAVER



Adjustable for Widths to 14 Ft.

No Weight, No Traction on New Road

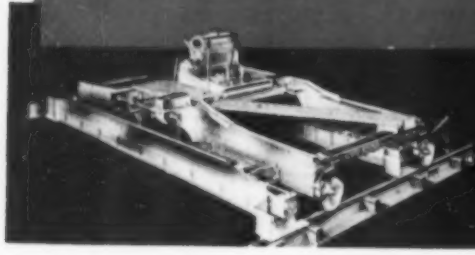
Lays It Smoother, Lays It Faster

On job after job with the Jaeger Bituminous Paver, three things stick out: (1) the unfailing approval of state engineers, (2) the excellent riding qualities of the road: (3) the capacity of the Jaeger Paver to lay huge tonnages in a working day.

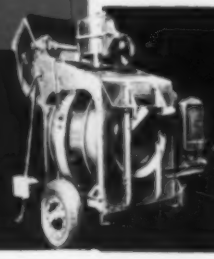
Road builders, who know that high production is the key to low costs, will tell you that their Jaeger Pavers lay material faster than their plants can mix it. No matter how sticky the mix, it passes easily thru Jaeger's re-mixing pugmill spreader. No matter how steep the grade or fast the pace, Jaeger's four semi-crawler wheels, always operating on the hard subgrade, have speed and traction to spare. No creeping or tearing of the new laid surface, because it is never touched by anything except the screeds.

Floating 18 ft. straight edge runners, which carry the screed and blenders, average out all irregularities in subgrade. Blenders complete perfect joints, lay flush to curb, increase built-in adjustability for wider widths, save costly hand finishing. The machine lays the road.

Before you buy any paver, before you bid any job—get our catalog, prices and complete details. THE JAEGER MACHINE CO., 800 Dublin Ave., Columbus, Ohio.

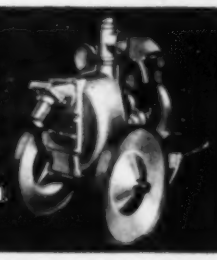


TYPE "D" FINISHERS for Highest Type Concrete, Bituminous Pavements

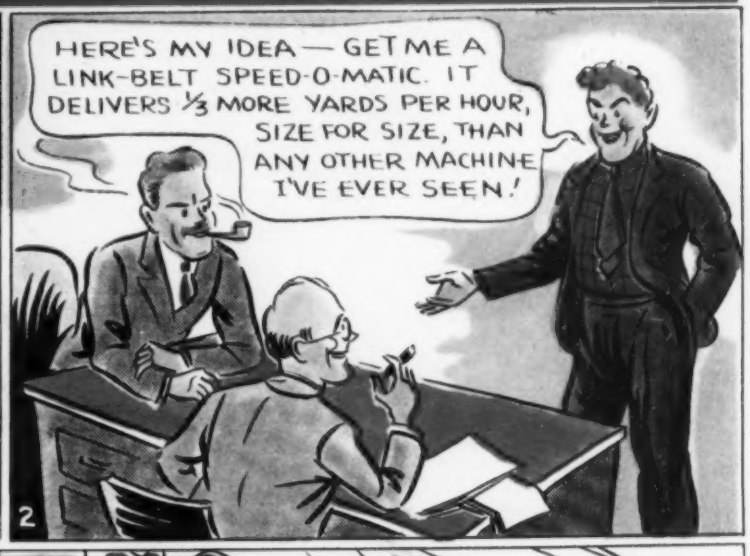


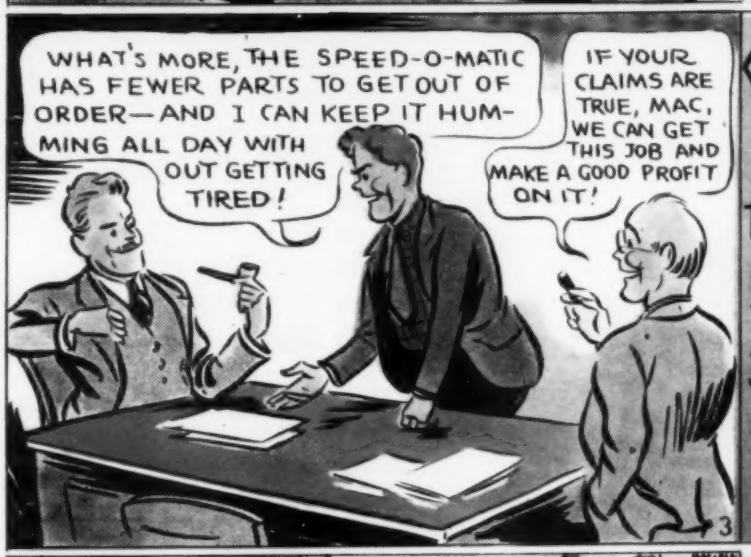
SPEED KING 10S Bridge Builder Mixers Other Non-Tilts, Tilters, 3½S to 56S Sizes

SURE PRIME Contractors' Pumps--2" to 10" Sizes, 7,000 to 200,000 G.P.H.



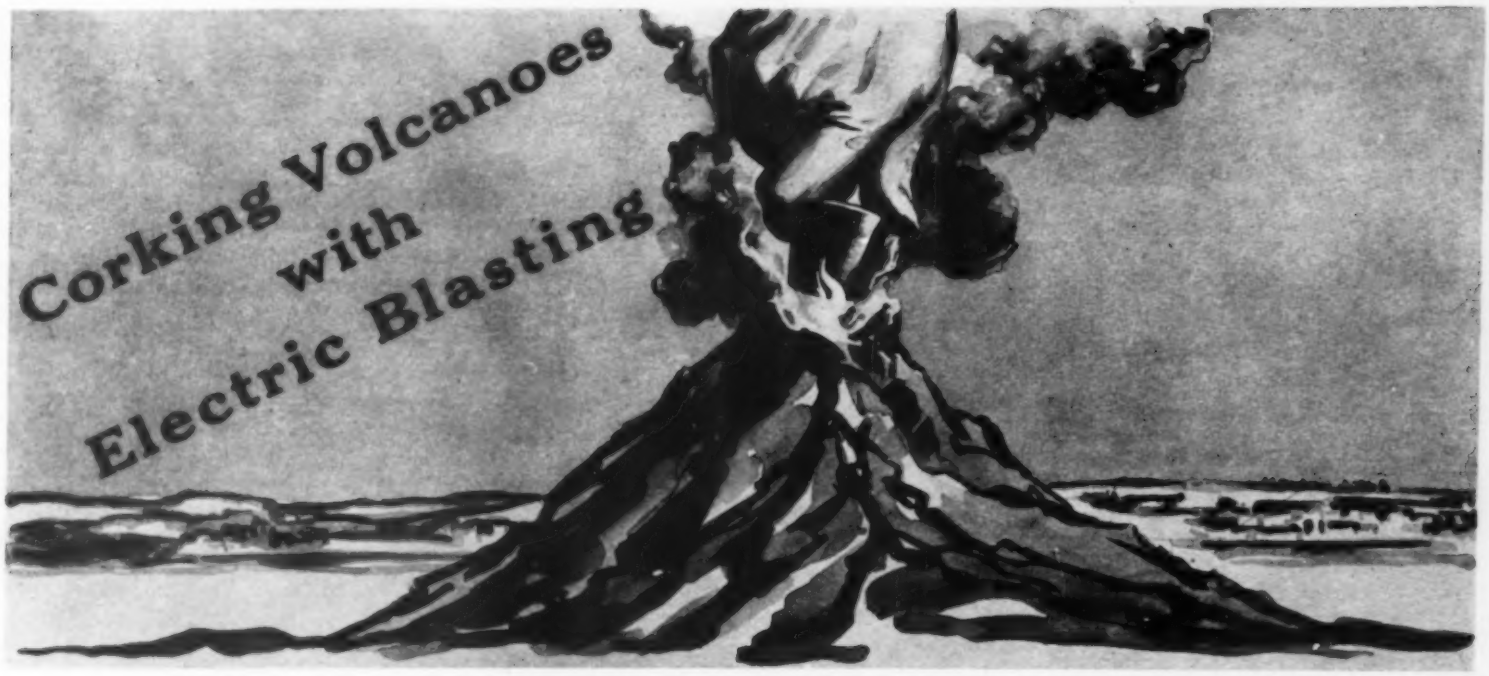
MAC O'MATIC AND HIS *Speed-o-Matic*





Speed-o-Matic Effort-les Control results in outputs so greatly increased, that claims based on actual data would appear extravagant. A visual demonstration is necessary for an appreciation of the astonishing results that are now obtainable. Address Link-Belt Company, 300 W. Pershing Road, Chicago. Offices and distributors located in principal cities. 5960

LINK-BELT *Speed-o-Matic*
SHOVELS—DRAGLINES—CRANES



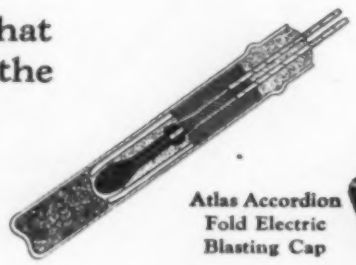
TERRIFIC FORCE generated by pressure within the earth may burst through the crater of a volcano. But—could the crater be corked the force would be compelled to work itself out through the rock.

Boreholes, like volcano craters, may let force escape. But with Electric Blasting, leg wires carry an impulse to the detonator without disturbing the stemming—boreholes remain tightly "corked," force becomes controlled force; and the explosive gases are kept working on the burden.

Atlas has long been the leader in the development of control afforded by improved Electric Blasting accessories and methods. The Match-Head Type Electric Blasting Cap, the Atlas Accordion Fold, the Big Brother Fold for long wire Electric Blasting Caps and the All-Metal Delay Electric Blasting Cap are some of the Atlas "Firsts" that are foremost in the field today.

Atlas representatives offer the benefits of a fine background of experience in the improvement of Electric Blasting methods. Get in touch with the nearest Atlas Branch Office.

Some ATLAS "FIRSTS" that give the electric blaster the ultimate in control.



Atlas Electric Blasting Cap

Atlas Accordion Fold Electric Blasting Cap

Atlas Twin-Fifty Blasting Machine

ATLAS POWDER COMPANY, WILMINGTON, DEL.

Cable Address—Atpowco

Everything for Blasting

OFFICES

Allentown, Pa.	Joplin, Mo.	New Orleans, La.	Pittsburgh, Pa.	Spokane, Wash.
Boston, Mass.	Kansas City, Mo.	New York, N. Y.	Portland, Oregon	St. Louis, Mo.
Butte, Mont.	Knoxville, Tenn.	Philadelphia, Pa.	Salt Lake City, Utah	Tamaqua, Pa.
Denver, Colo.	Los Angeles, Calif.	Picher, Okla.	San Francisco, Calif.	Wilkes-Barre, Pa.
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ATLAS

EXPLOSIVES

CHEMICALS ATLAS EXPLOSIVES

The "Quins" of Quality

Bring You A Well Balanced Wire Rope

CONSTRUCTION

It is also of great importance to use the type of wire rope suitable for the work to be done. To make this possible we manufacture "HERCULES" (Red-Strand) Wire Rope in a wide range of constructions, including Round Strand, Flattened Strand, Preformed, Non-Rotating and Steel Clad types. If you will tell us how you use wire rope, we shall be glad to suggest the construction we consider best for your work.

It takes more than Strength by itself to carry the load on present day construction work. Other indispensable members of the Leschen Quality Crew are Durability, Toughness, Flexibility, and Elasticity—and each lends a helping hand to bring you a well balanced wire rope.

And therein lies an important reason for the longer service which users are receiving from "HERCULES" Red-Strand Wire Rope, for a correct balance in all essential qualities is absolutely necessary if a wire rope is to be *consistently* dependable and long lasting.

Why not give this balanced and time tested wire rope a chance to prove what it can do for you?

Made Only By

A. LESCHEN & SONS ROPE COMPANY

ESTABLISHED 1857

5909 Kennerly Avenue, St. Louis, Mo.

New York	90 West Street	San Francisco	520 Fourth Street
Chicago	810 W. Washington Blvd.	Portland	914 N. W. 14th Avenue
Denver	1554 Wazee Street	Seattle	2244 First Avenue South

THE WORLD OKs

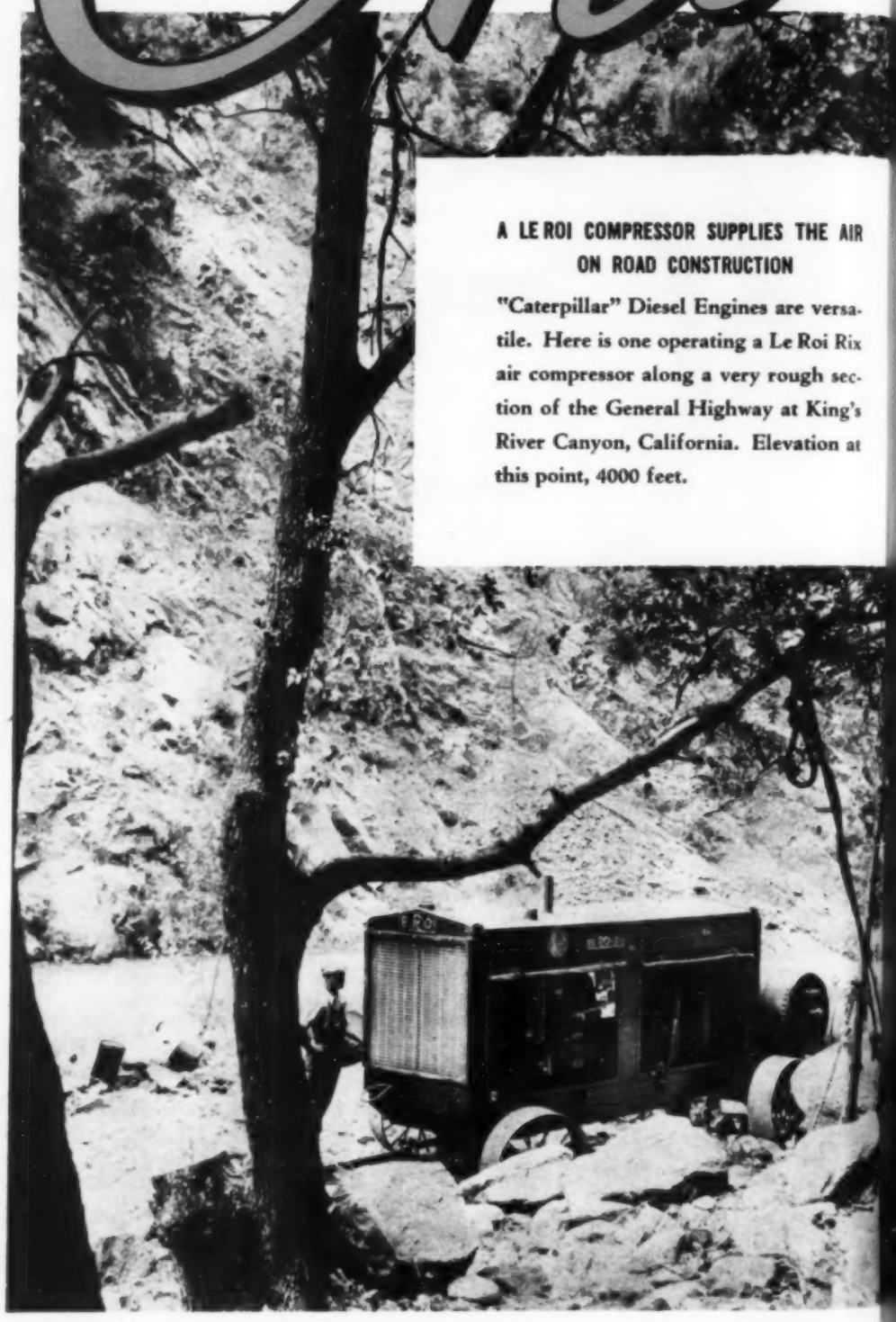
"Caterpillar" leadership is recognized . . . through the fact that Caterpillar Tractor Co. is the world's largest manufacturer of Diesel engines.

. . . Through the fact that its Diesel engines are used in virtually every form of industrial activity in which power — for hauling, earth-moving, shaft-turning, current-generating — is required.

. . . Through the fact that most of the nation's leading manufacturers of powered equipment use or provide for "Caterpillar" Diesels.

. . . Through the fact that "Caterpillar" Service is world-wide.

Ask for details about this low-cost type of power; and about the concern which has brought it to the highest state of development. Literature, cost figures and engineering suggestions on general or special installations are available. Address us direct or through the nearest "Caterpillar" dealer.



A LE ROI COMPRESSOR SUPPLIES THE AIR ON ROAD CONSTRUCTION

"Caterpillar" Diesel Engines are versatile. Here is one operating a Le Roi Rix air compressor along a very rough section of the General Highway at King's River Canyon, California. Elevation at this point, 4000 feet.

CATERPILLAR DIESEL

REG. U. S. PAT. OFF.

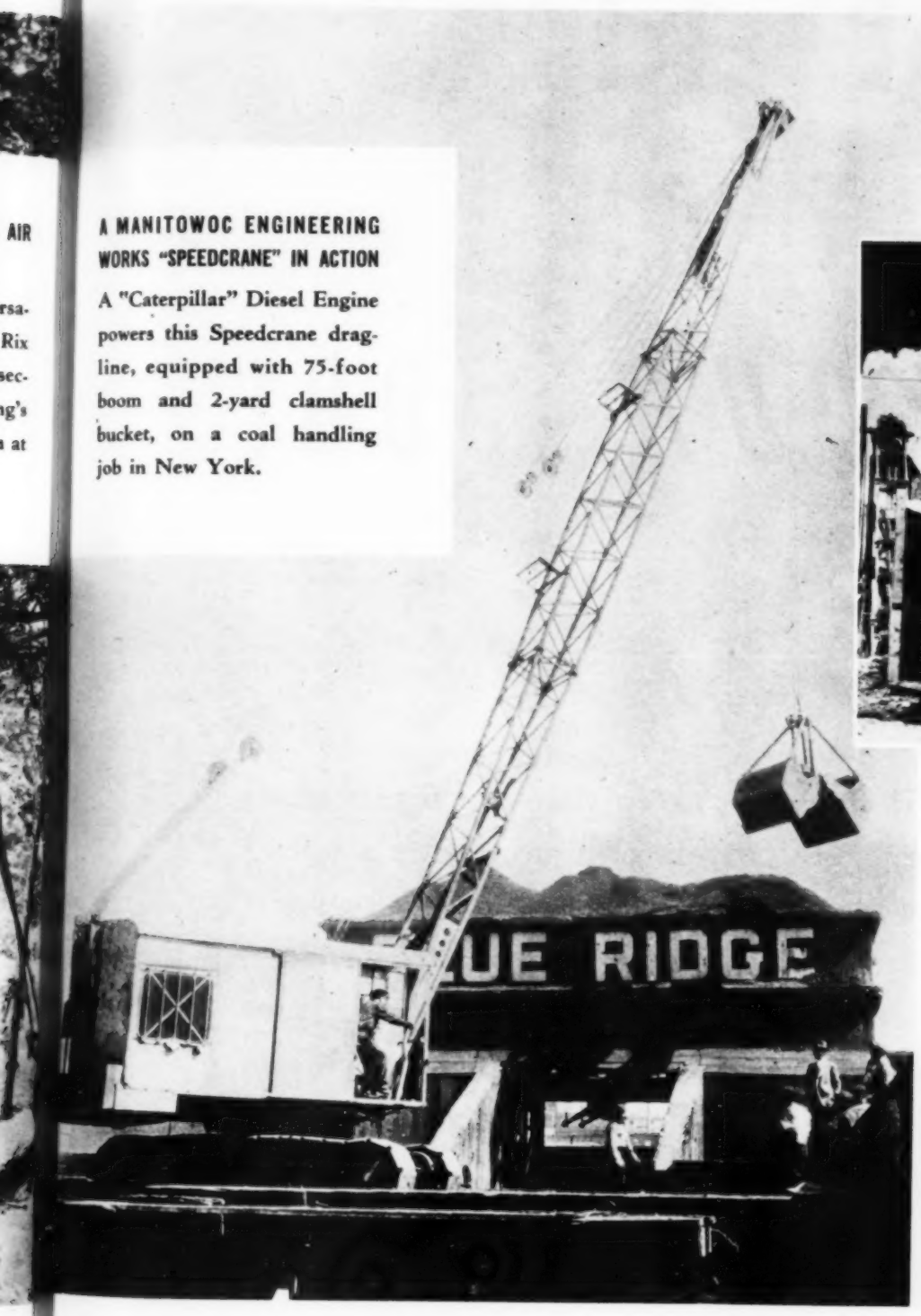
CATERPILLAR TRACTOR CO.
PEORIA ILLINOIS

WORLD'S LARGEST MANUFACTURER OF

"CATERPILLAR" DIESELS

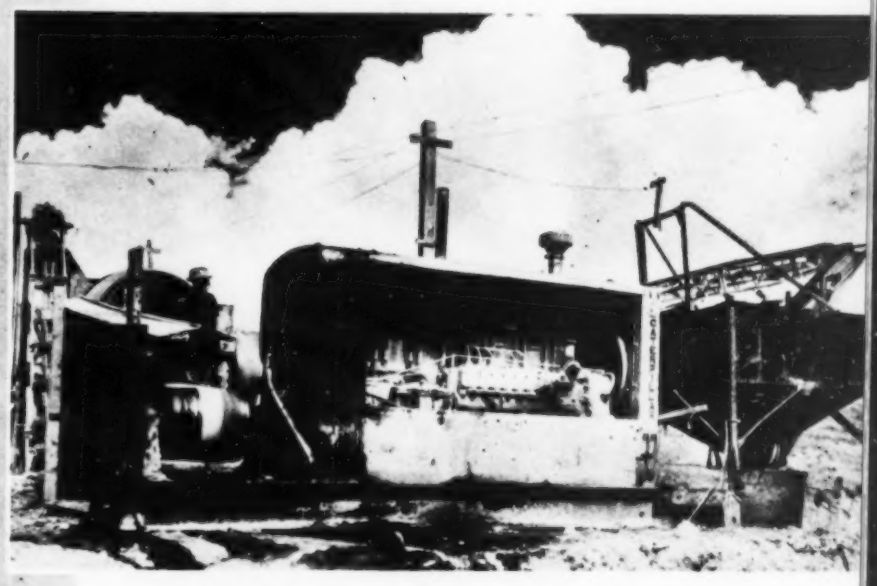
A MANITOWOC ENGINEERING WORKS "SPEEDCRANE" IN ACTION

A "Caterpillar" Diesel Engine powers this Speedcrane dragline, equipped with 75-foot boom and 2-yard clamshell bucket, on a coal handling job in New York.



CEDAR RAPIDS—A FAMILIAR NAME ON ROCK CRUSHERS

"Caterpillar" Diesel operating a Cedar Rapids rock crusher and screening plant on the operations of the W. W. Clyde Co., Springville, Utah. *Saving over former power used—50%.* A "Caterpillar" Diesel Tractor, equipped with bulldozer, is also at work on this job —pushing material from gravel pit to hopper.



"CATERPILLAR" DIESEL ENGINES are available in five sizes:

D17000 . . 160 HP. **D13000 . . 125 HP.**

D8800 . . . 80 HP.

D6600 . . . 60 HP. **D4400 . . . 44 HP.**

76 LEADING MANUFACTURERS POWER THEIR PRODUCTS WITH "CATERPILLAR" DIESEL ENGINES

Acme Road Machinery Company . Frankfort, N. Y.
Allsteel Products Mfg. Co., Inc. . Wichita, Kans.
American Hoist & Derrick Co. . . . St. Paul, Minn.
American Steel & Wire Co. . . . . Worcester, Mass.
Bay City Shovels, Inc. . . . . Bay City, Mich.
Berger Engineering Works, Inc. . . . Seattle, Wash.
Brookville Locomotive Company . . Brookville, Pa.
The Browning Crane & Shovel Co. . . . Cleveland, O.
The Buckeye Traction Ditcher Co. . . . Findlay, O.
Bucyrus-Erie Company . . South Milwaukee, Wis.
Buffalo Springfield Roller Co. . . . . Springfield, O.
Buhl Co., The . . . . . Chicago, Ill.
Byers Machine Co., The . . . . . Ravenna, Ohio
Canadian Sullivan Machinery Co., Ltd., Dundas, Ontario, Canada
Chase Turbine Co. . . . . Orange, Mass.
Clark Machinery Company . . Wichita Falls, Texas
Cook, Inc., A. D. . . . . Lawrenceburg, Ind.
Cunningham Machinery Corp. . . . Shreveport, La.
Davenport Besler Corporation . . . Davenport, Iowa
Davey Compressor Co., Inc. . . . . Kent, Ohio
Diamond Iron Works, Inc. . . . . Minneapolis, Minn.
Disston & Sons, Inc., Henry . . Philadelphia, Pa.
Dominion Hoist & Shovel Co., Ltd., Montreal, Quebec, Canada
Fulling Supply Co., Geo. E. . . . . Enid, Okla.
Fate-Root-Heath Company, The . . Plymouth, Ohio
Frick Co., Inc. . . . . Waynesboro, Pa.
Gardner-Denver Company (Canada), Ltd., Toronto, Ontario, Canada
Gardner-Denver Company . . . . . Quincy, Ill.
Georgia Iron Works . . . . . Augusta, Ga.
Gruendler Crusher & Pulverizer Co. . . . St. Louis
Gullett Gin Company . . . . . Amite, La.
Harmon, Alfred . . . . . Melbourne, Australia
Harnischfeger Corporation . . . . . Milwaukee, Wis.
Hendy Iron Works, Joshua . . San Francisco, Calif.
Highway Trailer Co. . . . . Edgerton, Wis.
Hopper Machine Works . . . . . Bakersfield, Calif.
Hug Company, The . . . . . Highland, Ill.
Iowa Manufacturing Co. . . . . Cedar Rapids, Iowa
Junior Monarch Hay Press . . San Leandro, Calif.
Koehring Company . . . . . Milwaukee, Wis.
LeRoi Company . . . . . Milwaukee, Wis.
Lima Locomotive Works, Inc. . . . . Lima, Ohio
Link-Belt Company . . . . . Chicago, Ill.
Manitowoc Engineering Works . . Manitowoc, Wis.
Marion Steam Shovel Co., The . . . Marion, Ohio
Mission Manufacturing Co. . . . . Houston, Texas
Morris Machine Works . . . . Baldwinsville, N. Y.
Mundy Hoisting Engine Co., J.W., Elizabeth, N. J.
National Supply Corporation . . . . . Toledo, Ohio
Novo Engine Company . . . . . Lansing, Mich.
Oil Well Supply Co. . . . . Dallas, Texas
Orton Crane & Shovel Co. . . . . Huntington, Ind.
Osgood Company, The . . . . . Marion, Ohio
Ottumwa Iron Works . . . . . Ottumwa, Iowa
Parsons Company, The . . . . . Newton, Iowa
Pioneer Gravel Equipment Mfg. Co. . Minneapolis
Pomona Pump Company . . . . . Pomona, Calif.
Puget Sound Machinery Depot . . . Seattle, Wash.
Randolph Company, O. W. . . . . Toledo, Ohio
Sauerman Bros., Inc. . . . . Chicago, Ill.
Schramm, Inc. . . . . West Chester, Pa.
Speeder Machinery Company . . Cedar Rapids, Iowa
Standard Steel Works . . . . . Los Angeles, Calif.
Sullivan Machinery Company . Michigan City, Ind.
Thew Shovel Company, The . . . . . Lorain, Ohio
Tilly Horizontal Drill Co. . . . . Tulsa, Okla.
Traylor Engineering & Mfg. Co. . . Allentown, Pa.
Universal Crusher Co. . . . . Cedar Rapids, Iowa
Universal Power Shovel Corp. . . . Milwaukee, Wis.
Vilter Manufacturing Co., The . . Milwaukee, Wis.
Vulcan Iron Works . . . . . Wilkes-Barre, Pa.
Washington Iron Works . . . . . Seattle, Wash.
Western Knapp Engineering Co. . . . San Francisco
Whitcomb Locomotive Co., The . . . Rochelle, Ill.
Wilson Manufacturing Co. . Wichita Falls, Texas
Worthington Pump & Machinery Corp., Harrison, N. J.

ENGINES

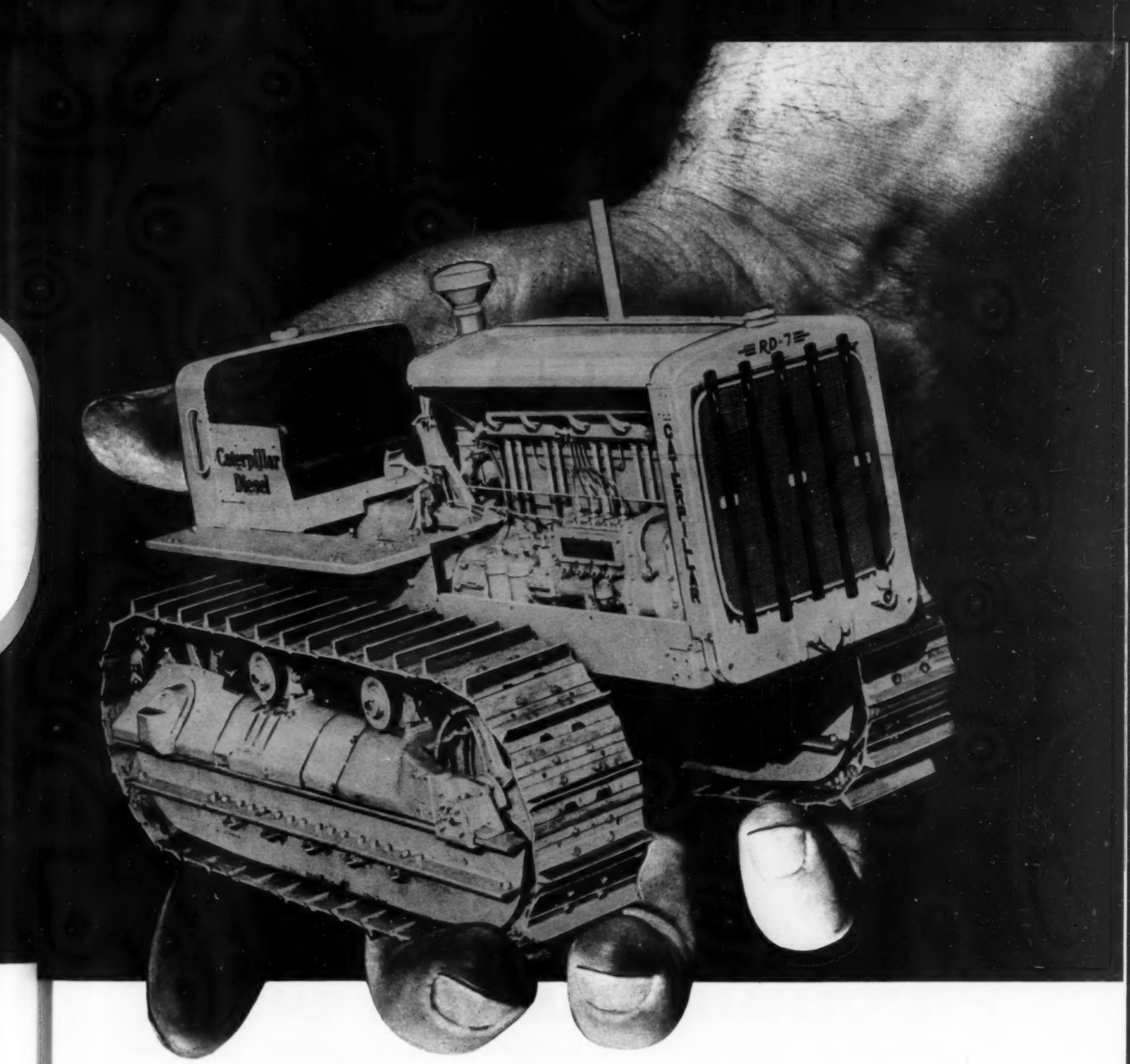
OF DIESEL ENGINES

TAKE IT
TRY IT ON
YOUR JOB!

Put your own operator in the seat . . . keep your own figures on its operating costs . . . doing work on your own job. Here's a tractor that will do your work at the lowest possible fuel and up-keep costs!

Demonstrate it to yourself! Try it with bulldozer or trail-builder, with wagons or scrapers, with blade grader or trailer patrol. If your job requires dependable, mobile, low-cost power, get in touch with a "Caterpillar" dealer today—tell him you are ready to be shown that Diesel power will cut your operating costs.

CATERPI



TRACTOR CO.
PEORIA, ILL.

WORLD'S LARGEST MANUFACTURER OF DIESEL ENGINES,
TRACK-TYPE TRACTORS AND ROAD MACHINERY

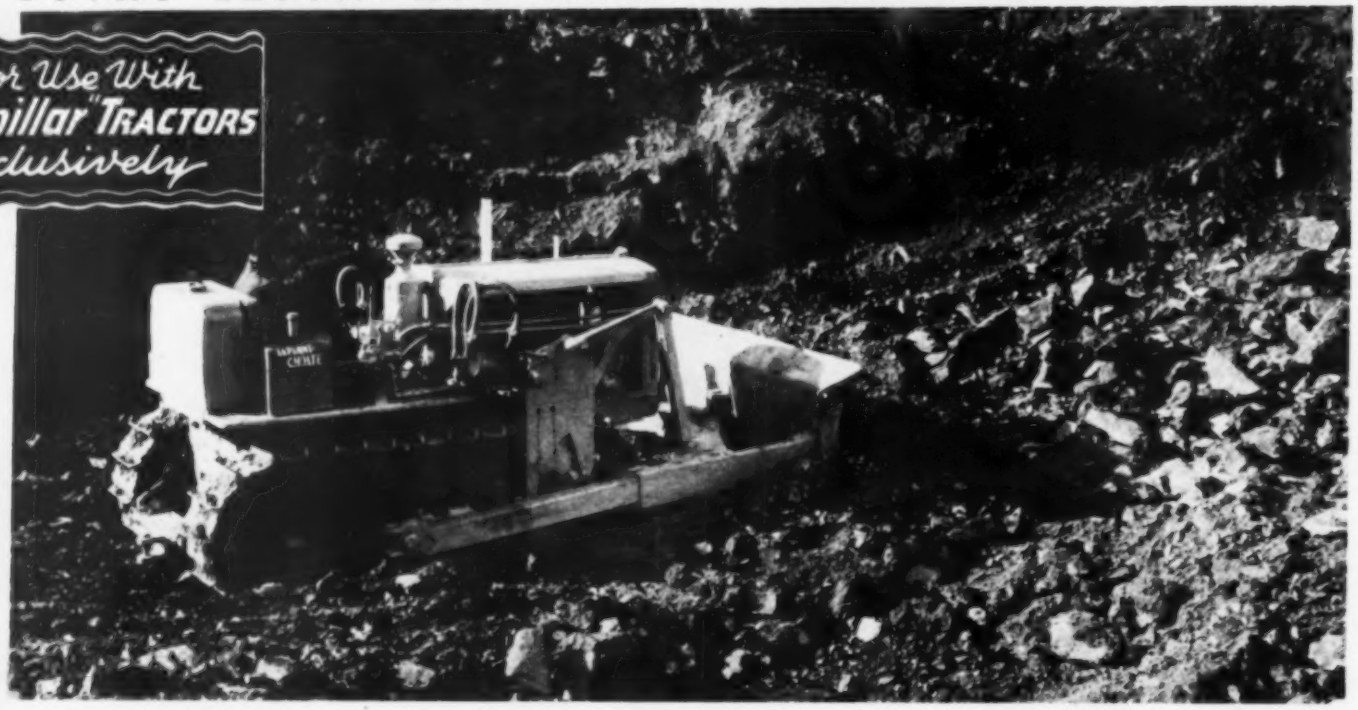
LaPlant-Choate

HYDRAULICALLY CONTROLLED

ROADBUILDERS

Provide Accurate and Positive Control!

For Use With "Caterpillar" Tractors Exclusively



PERFORMANCE THAT TOPS 'EM ALL!

For many contractors, the LaPlant-Choate Roadbuilder is a complete road-building unit. This Company pioneered the Bulldozer field and is the recognized leader today. The same applies to the Roadbuilder field. Long and successful experience in the manufacture of Roadbuilders, insures the best possible value to the contractor who demands the best!

A-FRAME CONSTRUCTION
Provides many distinct advantages in strength rigidity, and positive control.

EASY BLADE ADJUSTMENT
Blade delivery may be easily reversed or set straight for Bulldozing work.

HYDRAULIC CONTROL LEVER
Placed at a convenient point within easy reach of operator.

ENTIRELY TRACK MOUNTED
Strains in raising, lowering, or pushing are not transmitted to main frame or body of tractor.

HYDRAULIC CONTROLS ARE NECESSARY FOR ACCURATE & EFFICIENT RESULTS!

Hydraulic control is positive, accurate, and dependable. With its DOWN PRESSURE, the LaPlant-Choate Roadbuilder eliminates the need for a ripper. Also, hydraulic control enables the operator to place material in any desired layers thereby practically eliminating other finishing tools.

See Your Caterpillar Dealer
Or Write to LaPlant-Choate Mfg. Co., Inc.

FRONT MOUNTED PUMPS
Increase operating efficiency, hence are standard equipment on all models.

BOX-TYPE FRAME & BLADES
Embody great reserve strength. Strongest known construction.

INTERCHANGEABILITY
A LaPlant-Choate Roadbuilder may be converted into a Bulldozer by simply ordering the Bulldozer Blade and frame assembly. All other parts are interchangeable. This conversion feature likewise applies to Brushcutter and Snow Plow Blades.

BULLDOZERS • SCRAPERS • TAMPING ROLLERS • RUBBER WHEELED WAGONS • BRUSH CUTTERS • SNOW PLOWS

LaPlant-Choate Mfg. Co. Inc.
CEDAR RAPIDS, IOWA

effective now
PRICES CUT
5 to 20%
on LeTourneau Equipment

In the midst of a rising market on all the materials that go into LeTourneau equipment we are able to cut prices because of the fine business we are doing. This business, we believe, has come to us because LeTourneau equipment in the hands of hundreds of users has so thoroughly job proved its ability to move dirt cheap. As a result, our volume has grown to a point enabling us to make worthwhile savings in production costs. These savings are being passed on to you in price reductions of 5 to 20% on the entire LeTourneau line of Angledozers*, Bulldozers, Carryall* Scrapers, Buggies* Drag Scrapers, Cranes, Rooters*, and Power Control Units.

BULLDOZERS, ANGLEDOZERS

With this price cut, LeTourneau Angledozer and Bulldozer prices are as low, if not lower, than any others now on the market. Ask your Caterpillar tractor dealer for a demonstration and convince yourself of their superiority in performance as well as price.

*Name registered U. S. Pat. Office.

See your Caterpillar tractor dealer for complete prices . . . ask him for a demonstration

PEORIA, ILLINOIS

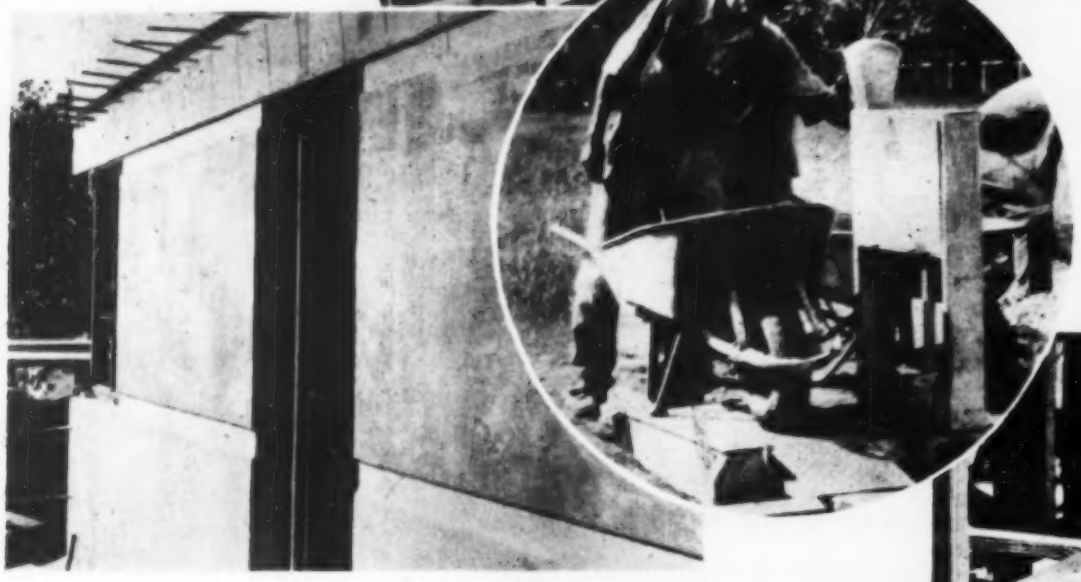
LETOURNEAU

STOCKTON, CALIFORNIA

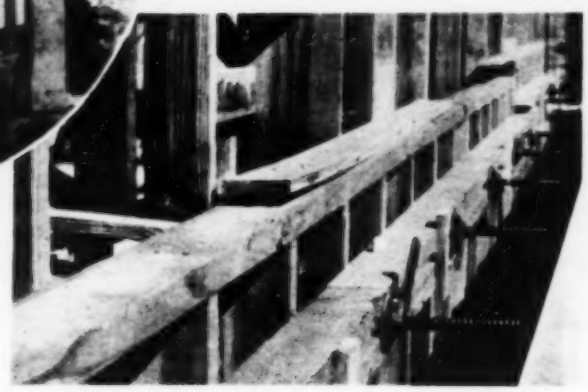
Cable Address: "BOBLETORNO"

Waller & Wells of Tulsa, Oklahoma did a scientific job of building this monolithic concrete residence for architect John Duncan Forsyth. All aggregates were carefully weighed. (See circle)

Here the forms are in place for the sixth lift completing the walls. Interior wall forms were of ship lap.



Walers were carefully lined to get a true wall. Exterior wall forms were of plywood designed for varying lifts without re-drilling for new bolt spacings.



Note the horizontal recesses for concealing construction joints. Surfaces were so good that the finished walls could be painted directly.

There's a big market for Contractors in firesafe CONCRETE HOMES

1936 proved beyond all question that concrete houses represent a big and growing market for contractors. This year, an enlarged program of national advertising plus closer coordination in following up inquiries should broaden the market still more. Get your share of this important business! Tie in with one of the realtors or subdividers who is organizing a construction department or seeking a connection with a builder. There's money in such cooperative set-ups.

The homes you build with concrete will *sell* because, properly built, they offer beauty with economy, firesafety and permanence. Your skill and experience in all kinds of concrete jobs give you an advantage in the construction of residence walls, floors, stairways and roofs. Porches, terraces, driveways and garages are *extra* profit opportunities.

Concrete houses can be built economically one at a time or by the hundreds. Check the coupon and attach to your letterhead for further information and practical booklet.

PORTLAND CEMENT ASSOCIATION
Dept. 2-16A, 33 W. Grand Ave., Chicago, Ill.

☐ I am interested in house construction as a profit opportunity.
☐ Send "Reinforced Concrete Houses—Construction Details."

Name .....
Company .....
Address .....
City ..... State .....

50% MORE CAPACITY
FOR ONLY 20 to 25% MORE INVESTMENT

The ¾ yd. Lorain-40 weighs but little more than most ½ yd. units—isn't much bigger—operates faster—runs as economically—is as easily transported—and requires only a small additional investment which is quickly more than balanced by the greater yardage it will move and the increased profits it will earn you . . . Also, on a given yardage, you'll run a L-40 fewer hours, hence less operating costs, less wear and tear on the machine; additional savings to increase your profits . . . No wonder the ¾ yd. Lorain-40 has convinced so many contractors of its profit possibilities and proved itself to their satisfaction . . . In no other way could it have become *"The World's Fastest Selling ¾ yd. Machine."*

THEW CENTER DRIVE

THE UNIVERSAL CRANE COMPANY • LORAIN, OHIO

LORAIN·40·*The World's Fastest Selling ¾ yd. Machine*

GMC

THE TRUCK OF VALUE

ATTENTION CONTRACTORS

INTRODUCING

A LOW-PRICED GMC "CAB-OVER-ENGINE" TRUCK

. . . a complete line of *truck-built* GMC cab-over-engine models ranging in capacity from 1½ to twelve tons . . . with distinctive streamstyling and exclusive "dual-tone" color design that sets a new standard . . . with rear-opening doors, utmost accessibility for servicing, exceptional comfort for driver, maximum visibility, all-steel "helmet-top" cab, correct wheelbases, forward location of front wheels and many other desirable features.

1½-ton chassis, $635 f. o. b. Pontiac, Michigan. Complete with cab only **$830**

See these COE values as well as the complete GMC line! . . . All prices f. o. b. Pontiac—Time payments through our own Y. M. A. C. Plan at lowest available rates

GENERAL MOTORS TRUCKS & TRAILER

GENERAL MOTORS TRUCK & COACH
DIVISION OF
YELLOW TRUCK & COACH MANUFACTURING COMPANY, PONTIAC, MICHIGAN

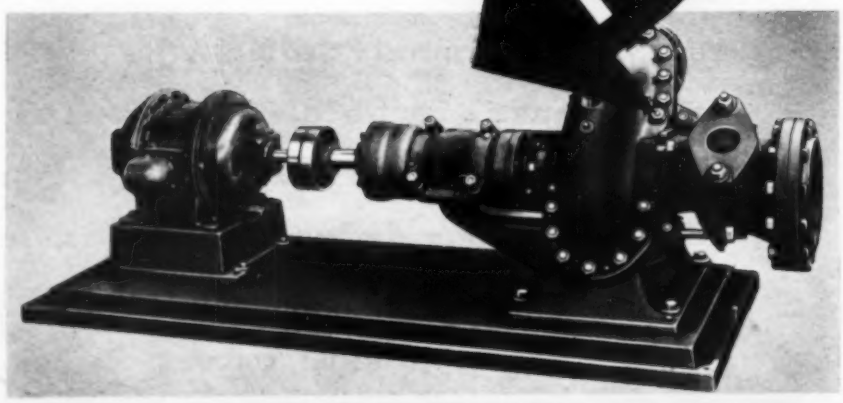
THESE show how Gould makes

PRESSURE-TIGHT, WEAR *and* CORROSION RESISTANT

GOULDS PUMPS, INC., Seneca Falls, N. Y., makes pumps for many uses, sends them out to jobs in all parts of the world. *Some* of them have to resist corrosion; ALL of them must resist wear and be pressure-tight.

For pump castings of many intricate shapes Gould has found that Nickel makes good cast iron better. Most of the casings and impellers above are cast with mixtures containing about 1% Nickel. The more uniform grain texture eliminates cracks, increases hardness and strength. Where pumps handle corrosives, Gould uses still more Nickel, casting parts with 14% Nickel, 2% chromium, 6% copper—the alloy known as Ni-Resist.

Consultation on the use of Nickel to meet your casting requirements is invited.



NI-RESIST★ NICKEL CAST IRON

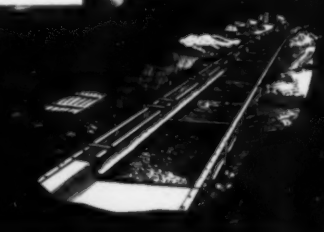
Reg. U. S. Pat. Off. by The International Nickel Co., Inc. Canadian Patent—278,180

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL ST., NEW YORK, N. Y.

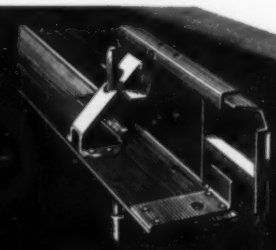
Experience says.. buy BLAW-KNOX

Portable Weighing
BATCHERPLANTS

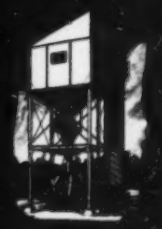
ROAD FINISHERS



STEEL STREET FORMS



NEW ROAD FORMS



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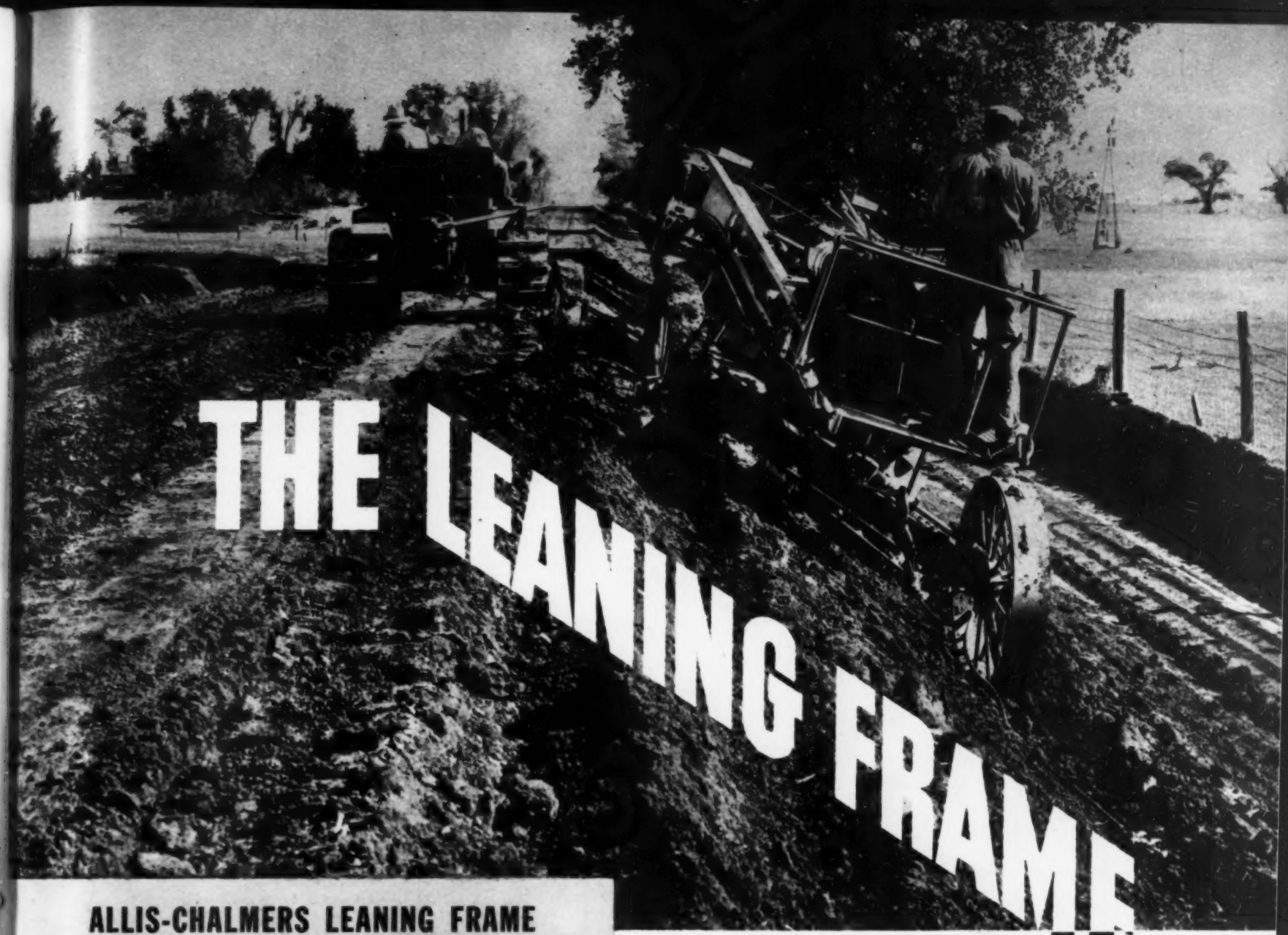

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ATLAS WHITE PORTLAND CEMENT
FOR TRAFFIC MARKERS

Established 1919
McGraw-Hill Publishing Company, Inc.

Construction Methods and Equipment

ROBERT K. TOMLIN, Editor

Volume 19 Number 2

February, 1937

"Whirligig" Concrete Chute

Lines Circular Shafts

AN INGENIOUS DEVICE for placing concrete lining in the control shafts, 50 ft. in diameter and 250 ft. deep, of four diversion tunnels at Fort Peck dam has greatly accelerated the work. A unit consisting of a steel-framed hopper equipped with a revolving chute is suspended by cables in the center of the shaft and is supplied with concrete by buckets lowered from above. When shaft lining began, concrete was delivered to hoppers which had to be moved around the circle as concreting progressed. Development of the new revolving-chute device practically doubled the production per shift.

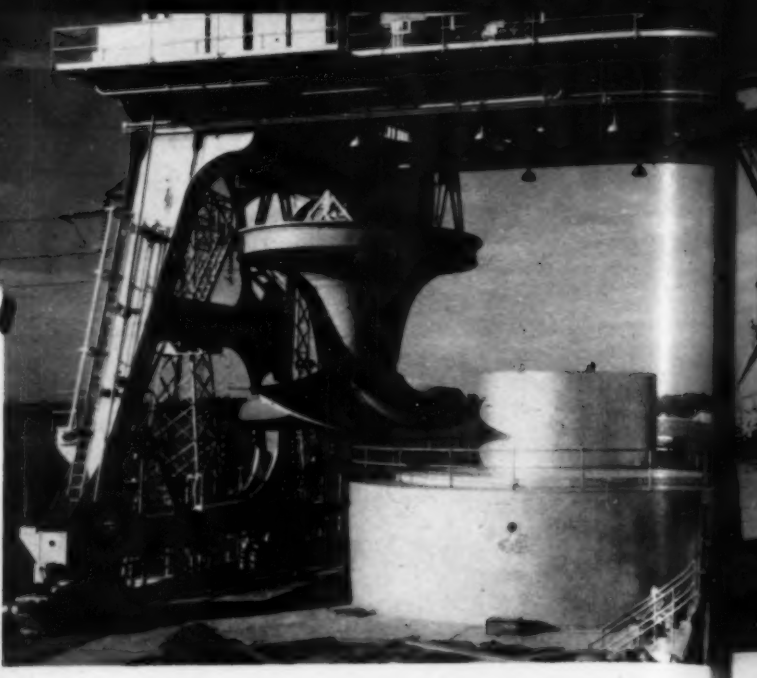
Supporting cables of the concrete distributing unit are pinned to the steel frame in which the hopper is mounted. On a revolving bearing below the hopper is suspended a pair of A-shaped timber trusses carrying a chute through which concrete is discharged from the hopper to the wall forms. The chute rotates around the circumference of the shaft as concrete for each 16-ft. 8-in. lift of the lining is placed. Concrete buckets lowered by derrick from the surface discharge into the hopper, as shown by the photograph above.

Each shaft was lined when excavated with corrugated steel plates backed up by I-section studs and truss rings. Excavation was made to 60-ft. diameter. Inside the steel plate lining (packed with grout on the outside to assure uniform bearing against the rock) the shafts are lined with (1) a 3-ft. thickness of reinforced concrete, (2) a welded steel shell $\frac{5}{8}$ to $1\frac{1}{4}$ in. thick and (3) a final reinforced-concrete lining 2 ft. thick.

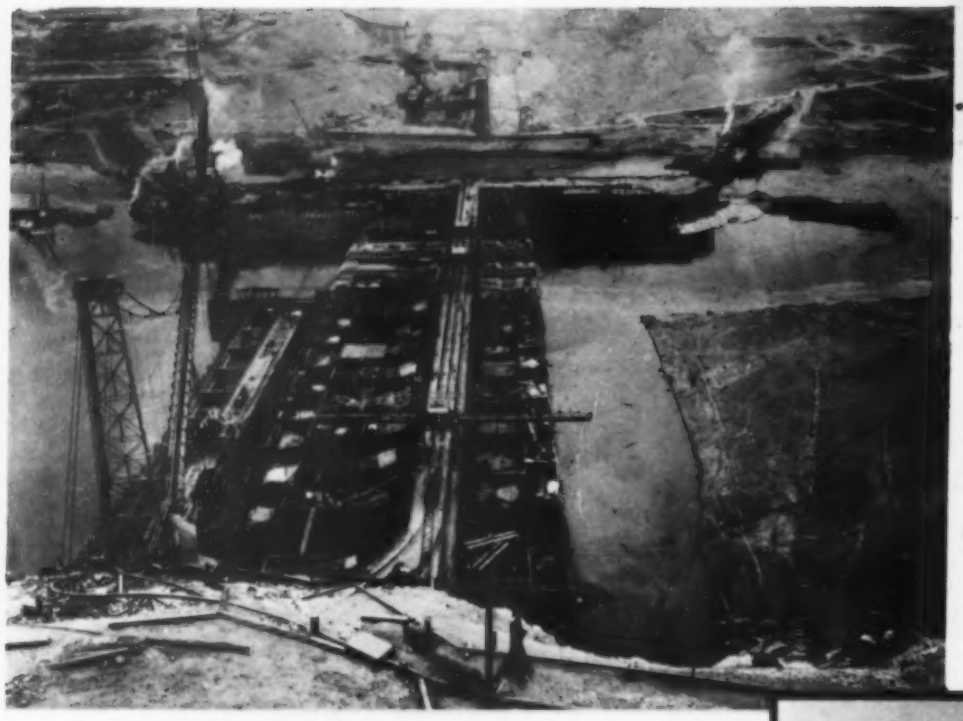
Fort Peck dam is being built under the direction of the Missouri River Division, Corps of Engineers, with Col. R. C. Moore, division engineer, Kansas City, Mo., in general charge. Lt.-Col. Thomas B. Larkin, district engineer of the Fort Peck District, is in direct charge of the project. Construction of the tunnels is under the direction of Capt. A. W. Pence.

This Month's

"NEWS REEL"



U. S. Bureau of Reclamation Photo



GRAND COULEE DAM

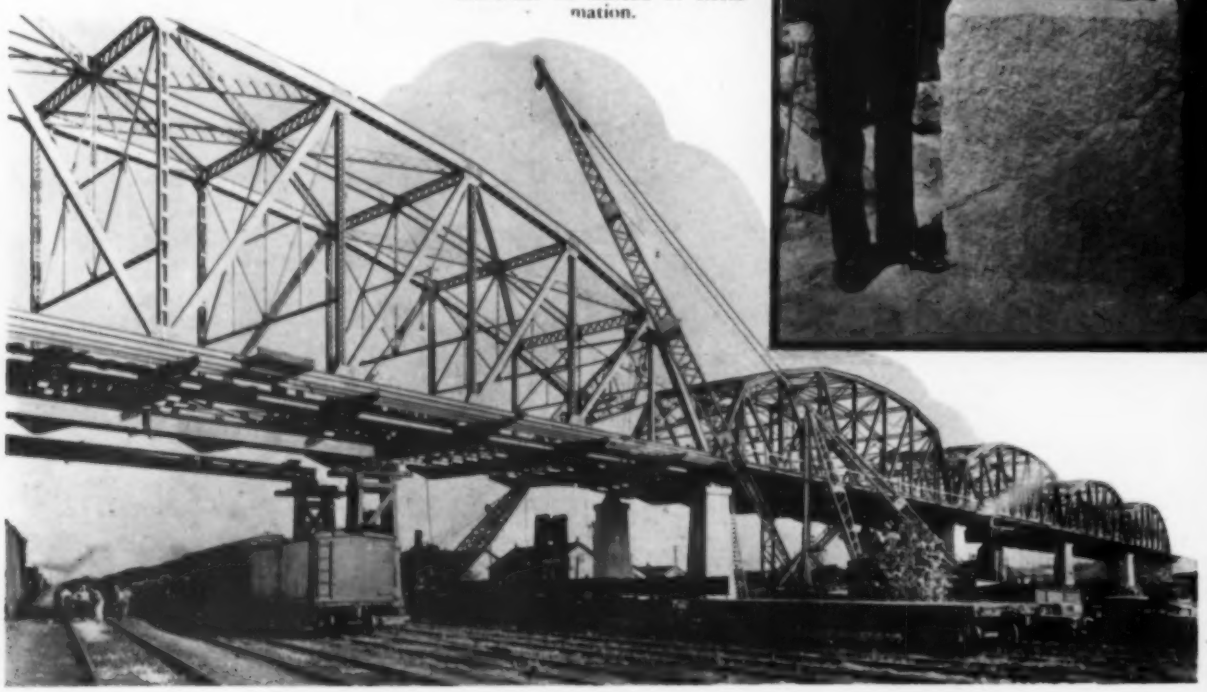
(left) goes into second major phase of construction with closing of east cofferdam (in background) across Columbia River channel, in which part of east section will be constructed. Concreting now is in progress in east excavation behind natural bulkhead which will be broken through in spring after cofferdam has been unwatered. More than 1,750,000 cu.yd. of concrete has been placed in west section (in foreground) which is now passing river flow through four blocks in dam, following removal of upstream and downstream arms of west cofferdam.

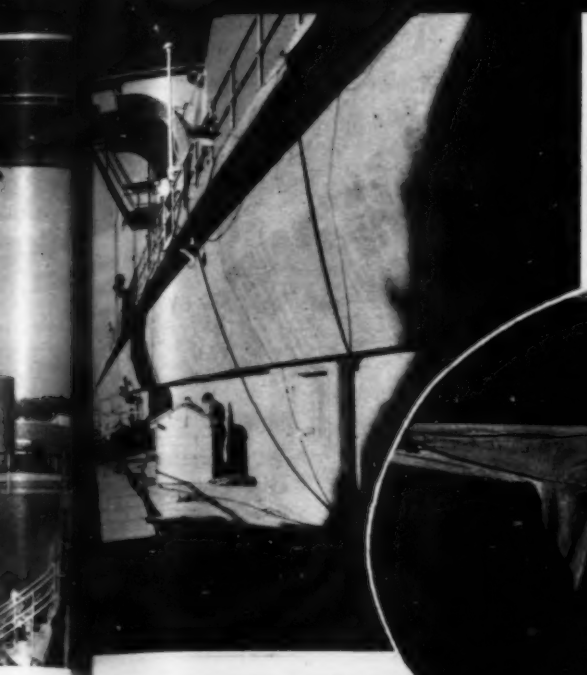
INDIANA HIGHWAY VIADUCT

(below) comprising seventeen spans having total length of more than 2,100 ft. is built by E. J. Albrecht Co., Chicago contractor, for Indiana Highway Commission, across 67 tracks of railroad yard south of East Chicago. Structure, built with federal funds allocated for grade separations under Works bill, cost about $600,000 and required more than 3,000 tons of steel and 23,000 bbl. of cement.

PLAQUE

(right) honoring late Dr. Elwood Mead, until his death commissioner of U. S. Bureau of Reclamation, is unveiled at Boulder dam, culminating project of Dr. Mead's life. Beside plaque stand E. K. Burlow (left), administrative assistant to Secretary of Interior Harold L. Ickes, and John C. Page, acting commissioner of Bureau of Reclamation.





WHEELER DAM POWER

(left) will be doubled when propeller, being moved to position by gantry crane on outdoor power house, begins turning generator of second 45,000-hp. unit. First generator, protected from weather by removable metal cover in foreground, already is in operation at this TVA project on Tennessee River. Power house is designed for eventual installation of eight vertical-shaft turbines.

WORLD'S FAIR BOND BUYER

John C. Weir *(left)*, operator of large earth-moving truck for Arthur A. Johnson Corp.-Necaro Co., Inc., contractors, at site of New York's 1939 exposition, buys $100 certificate from Grover Whalen, president of Fair.

JANE ADDAMS HOUSES

$1,950,000 Chicago project of PWA Housing Division, are pushed toward completion by S. N. Nielsen Co., of Chicago, contractor.

DEPARTMENT OF INTERIOR BUILDING

is newest of federal government's structures to house departmental offices in Washington, D. C. Building, costing $11,000,000 and containing 700,000 sq.ft. of floor area, will be completed this year by George A. Fuller Co., contractor.

FORT PECK DIVERSION TUNNELS

complete final stage of enlargement as Col. T. B. Larkin, U. S. district engineer in charge of Fort Peck District, places bronze bolt in last ring beam at inlet portal of tunnel No. 4. Capt. A. W. Pence, engineer in charge of tunnels, holds wrench while O. F. Brinton (at right), general superintendent of tunnel construction, looks on.

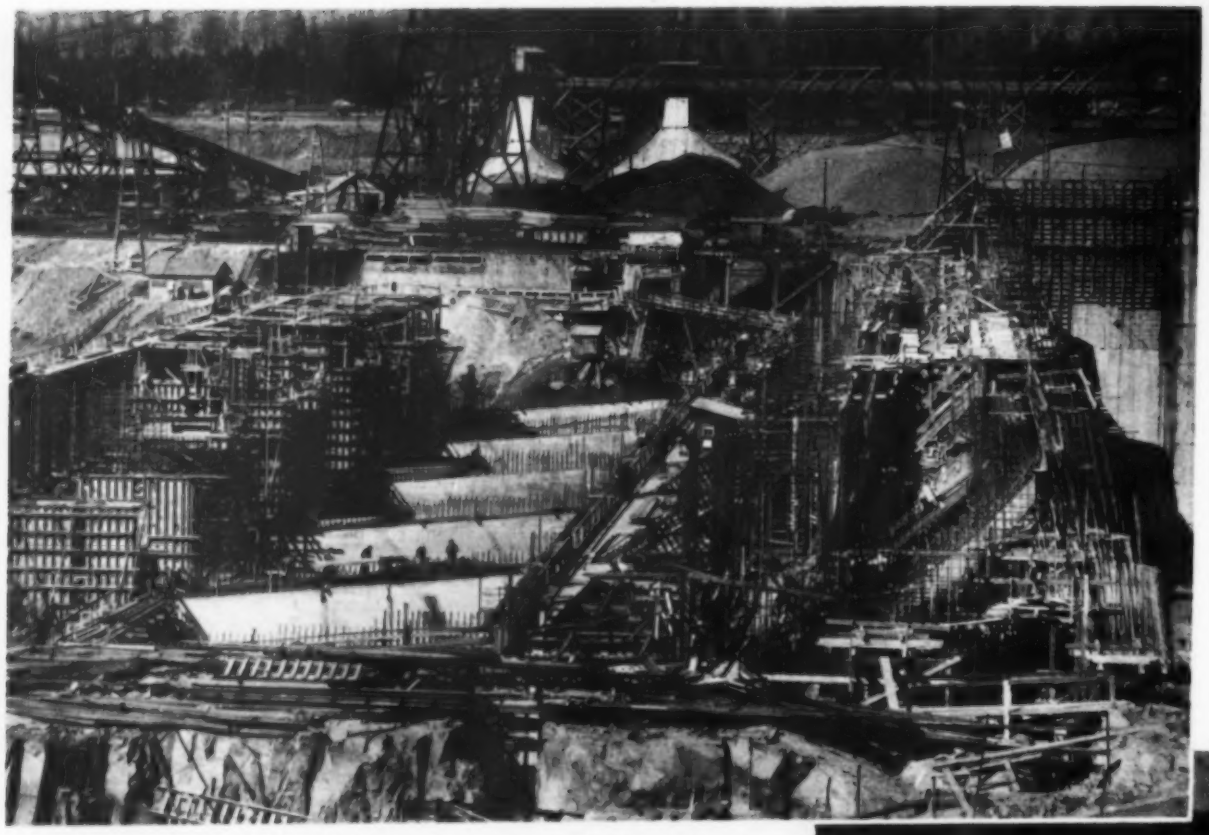
Cableway

Delivers Materials to Bonneville Lock and Power House From

Compact Island Plant

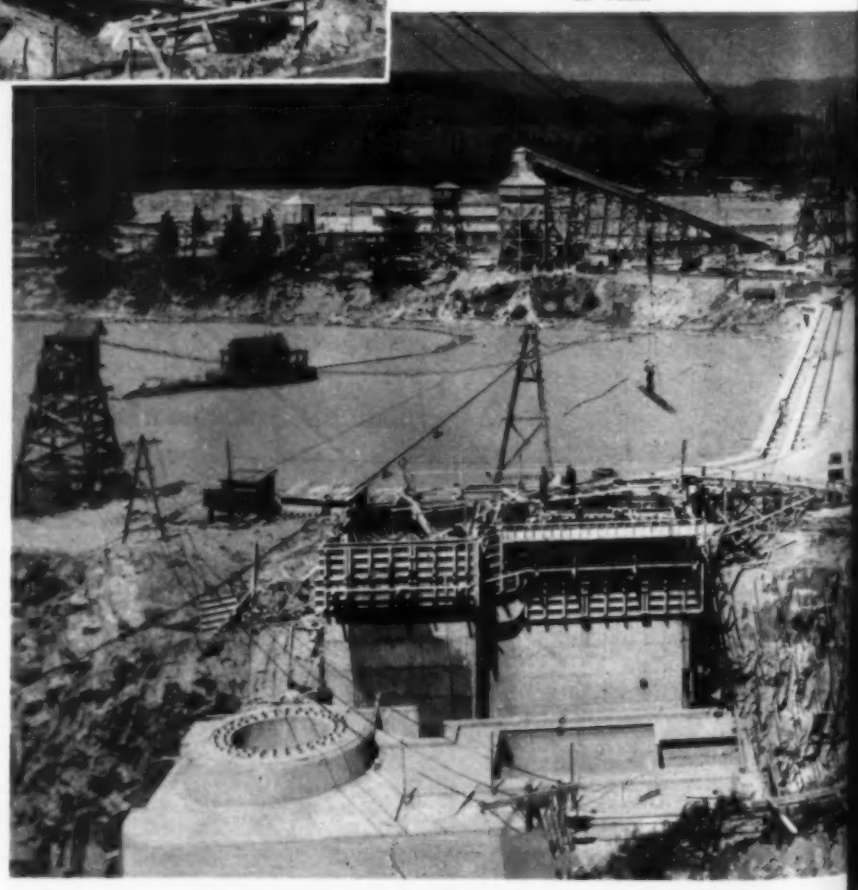
By J. F. McEACHERN

General Construction Co. & J. F. Shea Co., Inc.



SAND STOCKPILES (in background) are protected with canvas covers to maintain uniform moisture content during rainy season.

TWO CABLEWAYS *(below)* anchored to common tail tower on Bradford Island provide large concreting capacity during early part of work.

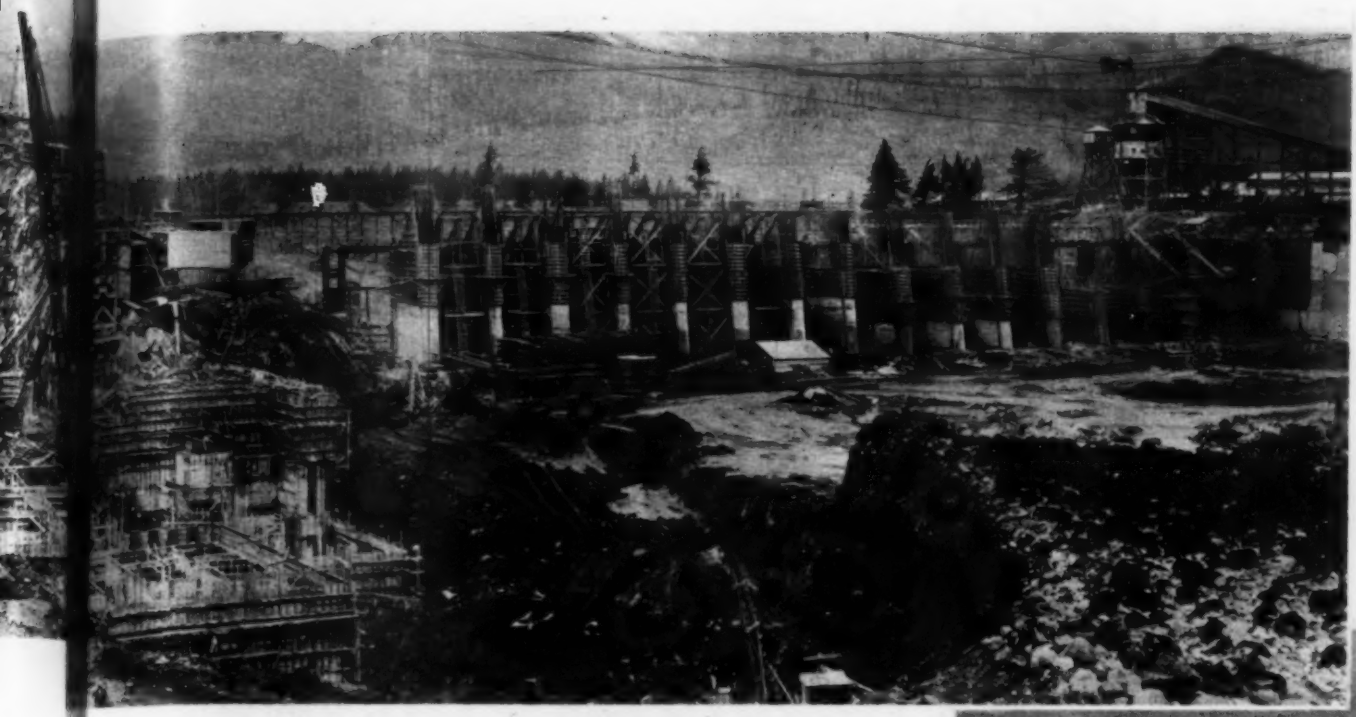


IN SELECTING EQUIPMENT and laying out the construction plant for building power-house foundation, navigation lock and fishways of the Bonneville project on the Columbia River in Oregon, a major consideration was the limited space available to the contractor. The ground surface slopes up steeply close to the water's edge on the lock side of Bradford Slough, and adequate space for contractor's plant was not available on this shore either below or above the site. The area finally selected was a portion of Bradford Island adjacent to the power house on the north.

A disadvantage of this location was that it was necessary to provide access across Bradford Slough which separates the island from the south bank of the river. This necessity was met by building roadways for trucks on the earthfill cofferdams which close off the slough channel above and below the power house. Rail access was provided by a trestle built near the lower cofferdam. A third route giving both truck and rail access to the island (for use as a permanent roadway after removal of the cofferdams) was via a swing bridge across the downstream end of the lock and thence over the tailrace of the power house. All the early construction work was done with sole dependence upon access by way of the cofferdams and the trestle. Except for the head tower of a cableway spanning the power-house site, plant and equipment was concentrated on the island as shown in the accompanying drawing.

The contract was signed on Aug. 7, 1934, and completion was required in 10 months — less than half the time ordinarily required for a job of this extent. Thus the demand for speed was a controlling factor.

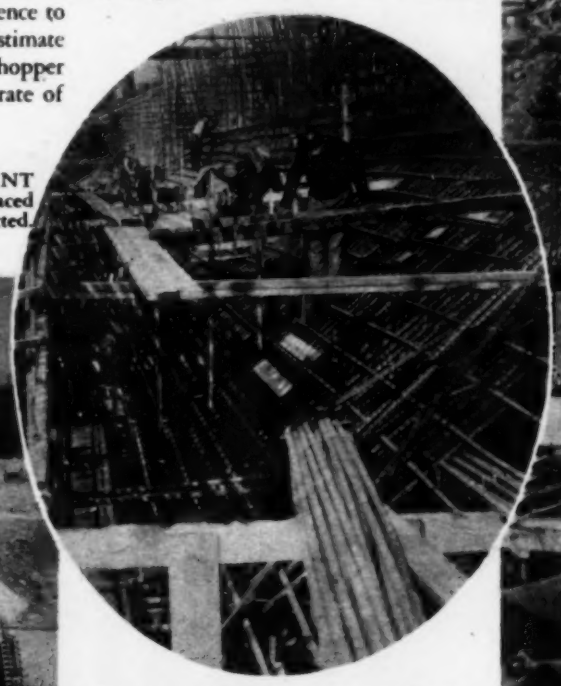
Materials Handling — Classified aggregate consisting of two grades of sand and three sizes of rock were delivered in bottom-dump railroad cars to a track hopper. From beneath the hopper an apron feeder moved material to a bucket elevator (made necessary by the steep slope) delivering to a conveyor belt which in turn discharged on to the various storage piles. Beneath these piles a single belt conveyor in a timbered tunnel delivered the various grades of aggregate to the bins in the batching plant. Canvas covers or "skirts" were anchored over the sand piles during the rainy season



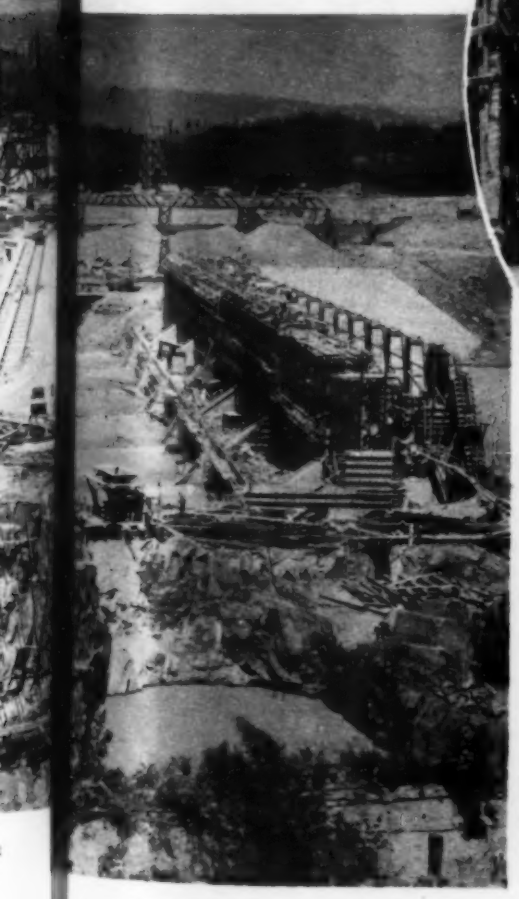
UPSTREAM SIDE of power house and navigation lock (at left) during construction. Concrete mixing plant on Bradford Island appears at right. Concrete forms at intake end of lock indicate final stages of concreting deep hole at this point.

to prevent heavy showers from causing sudden changes in moisture content.

Bulk cement arrived on the job in box cars and was unloaded by mechanical scrapers into a hopper alongside the railroad siding. The choice of scrapers for unloading in preference to pumps was governed by the estimate of comparative costs. From the hopper the cement was pumped at the rate of 200 bbl. per hour either to the storage silo above or through an underground pipe delivering directly to the cement bin at the mixing plant. Water for the mixers was supplied through a 2,000-gal. wooden tank on a tower near the mixing plant. Johnson batching equipment delivered to two 3-cu.yd. tilting mixers built by the Norris K. Davis Co., designers of the 8-cu.yd. cars into which the mixers deliver.

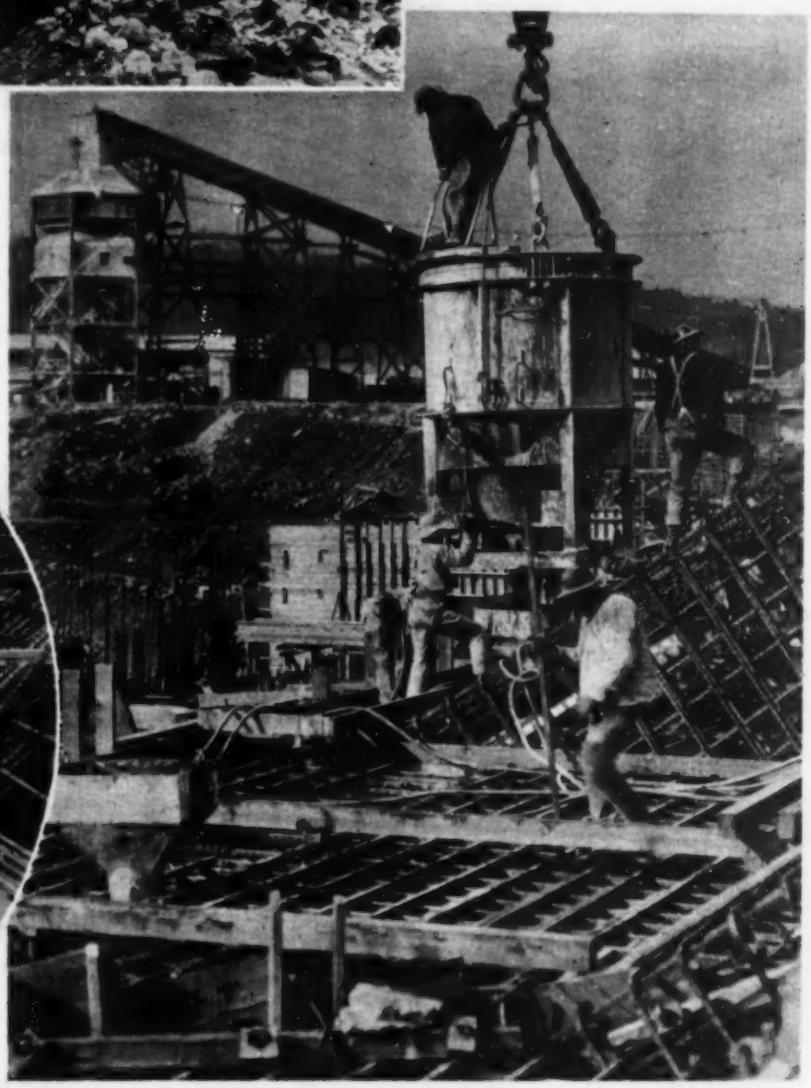


HEAVY REINFORCEMENT *(right)* for power house is placed before concrete forms are erected.



Concrete cars were hauled by gasoline locomotives to a bucket landing underneath the cableway which was erected across the power-house site for delivering concrete. The contents of each 8-cu.yd. car were discharged into a bucket equipped for quick and convenient bottom dumping within the forms. The design of these concrete cars was such as to avoid use of a discharge gate. Each car consisted of two rectangular hoppers with a central chute between them; the assembly was supported on two four-wheel trucks of standard railroad gage. To discharge the concrete the two hoppers were tilted upward simultaneously toward the central chute by hydraulic pistons operated by an electrically driven pump. This movement dumped the concrete into the chute, which in turn delivered to the cableway bucket. The interior of the hopper was such that in the tilted position all the contents flowed out leaving a clean hopper ready for the next batch.

Cableway — The cableway, a product of the Washington Iron Works, consisted of a track cable 3 in. in diameter with a span of 1,400 ft. extending from the tail tower on Bradford Island to a head tower on a double set of tracks 579 ft. long, laid on a curve (of 1,400-ft. radius) along the south bank above the navigation lock. All cableway machinery was located in the head tower and was operated by remote control. Foremen of the concrete crews signalled the operator by means of yellow-and-white disks. When the construction plant layout was under consideration trestle and cableway were compared as means of delivering concrete. The cableway was selected because of the advantages it offered in the matter of flexibility. From the start of the job until June 1, 1935, two cableways were used continuously, each operated by its own head tower but anchored to a common tail tower. Later, only the cableway across the power-house site was needed, and the other one was dismantled.



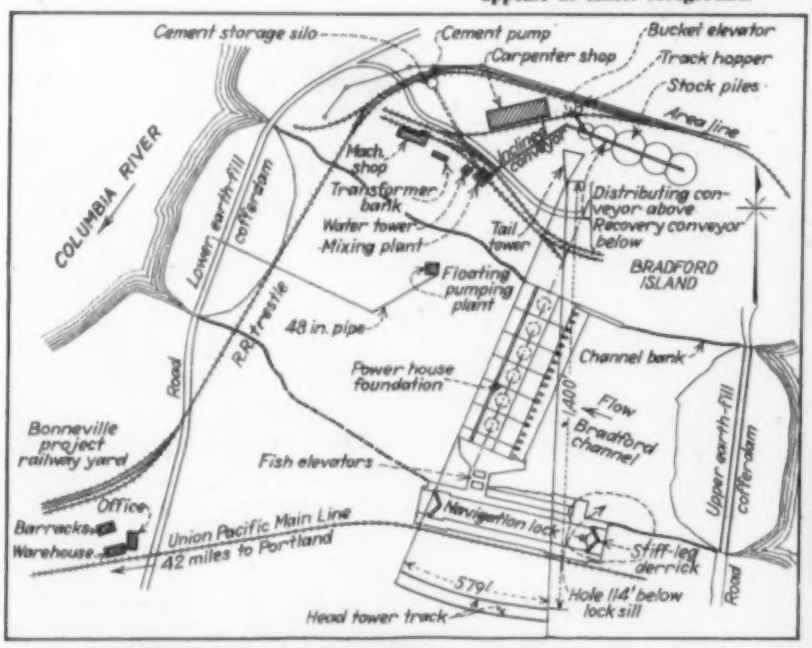
CONCRETE BUCKET of 8-yd. capacity delivers 6-yd. batch to power house. Workman riding on bucket signals cableway operator with colored disk.

Most of the concrete in the power-house foundation was placed directly from the cableway buckets. To place

some small quantities in outlying locations a supplementary delivery system was developed by the use of derricks and pumps. Rex Pumpcrete machines with 8-in. delivery pipes handled as much as 75 cu.yd. of concrete per hour in delivery to points beyond reach of the cableway.

Pumping Plant — Seepage into the channel between the two cofferdams was removed by a pumping station consisting of three 20-in. and one 12-in. Bingham horizontal centrifugal pumps. Capacities of the driving motors were 300 and 150 hp. respectively. The pumps discharged to a 48-in. swing pipe on pontoons which in turn delivered to two 42-in. wood stave pipes emptying into the Columbia River below the lower cofferdam. These pumps as well as most of the other power requirements on the job were supplied with electrical energy from a centrally located transformer bank. Transformers received energy at 11,000 volts and stepped it down to 440 and 220 volts.

HIGH WATER in Columbia River floods area between cofferdams in Bradford Slough during construction of power house. Floating pumping plant appears in center foreground.



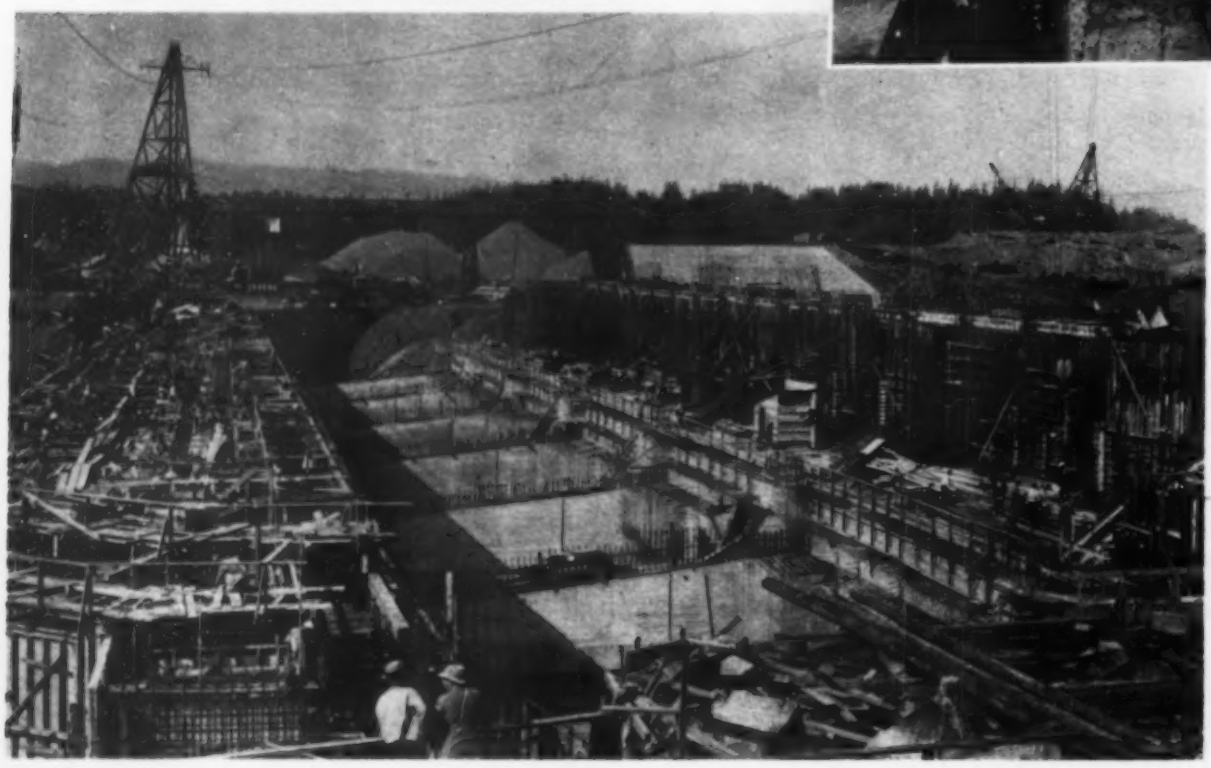
CONSTRUCTION PLANT LAYOUT at Bonneville for lock and power-house foundation. Space limitations put most of equipment on island across Bradford Channel.

At the upper end of the navigation lock unforeseen problems were met in removing some 130,000 cu.yd. where bedrock was at the bottom of a deep hole. The depth, unknown at the start, proved to be 114 ft. below the lock sill, much of this depth being through extremely fine sand, almost a quicksand when wet. Well points were driven to aid in unwatering and a stiff-leg derrick was set above the excavation to hoist out the spoil and load it on motor trucks.

Personnel — The Bonneville project is being constructed under the direction of the Corps of Engineers, U.S. Army. Col. T. M. Robins is division engineer and Lieut.-Col. C. F. Williams is district engineer. At Bonneville, Capt. J. S. Gorlinski is resident engineer and B. E. Torpen construction engineer.

AUTOMATIC EQUIPMENT controls batching of concrete ingredients in mixing plant.

Contract for the power-house foundations and the navigation lock (representing about 490,000 cu.yd. of excavation and placement of 240,000 cu.yd. of concrete) was carried out as a joint venture by the General Construction Co. and J. F. Shea Co., Inc. The power-house superstructure also was built by these associated companies under a later contract. J. A. McEachern is president of General Construction Co., and Charles A. Shea is president of the J. F. Shea Co. The author was on the job during part of the construction period.



POWER HOUSE *(left)* is concreted with aid of two cableways from common tail tower in background.

Contractor Maintains Fast Schedule on

Cold-Weather Concrete Job

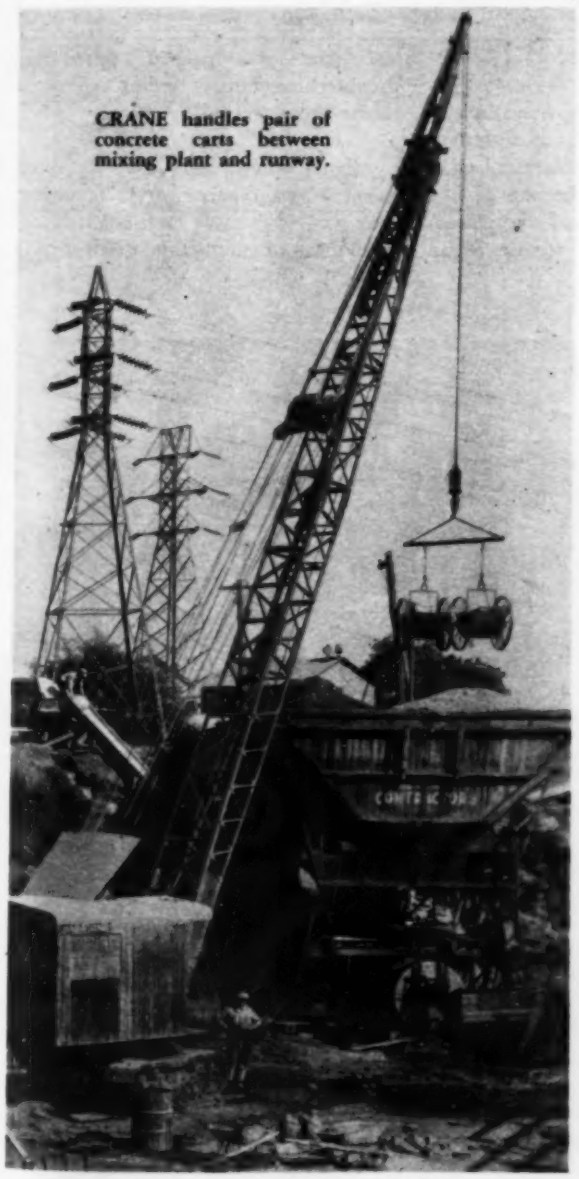
By ERNEST GRUENWALD

Engineer, Incor Division,
Lone Star Cement Corp.

IN SPITE OF sub-freezing temperatures that prevailed last winter, a program of modernization was carried out on a summer construction schedule at the Nazareth, Pa., plant of the Lone Star Cement Corp. The work consisted of a new crusher building 31 by 29 ft. in plan and 51 ft. high, and a rock storage building roofed with a 79-ft. span parabolic concrete arch. The work was performed by the M. A. Long Co. under the supervision of E. C. Machin, general manager of the contractor's Allentown division.

Skillful forming, adequate heat protection and the use of high-early-strength cement made it possible to complete the work on a fast summer schedule. A definite saving in heat protection expense was a feature of the job. Also noteworthy was the use of the sliding form method both on the crusher building and on tapered concrete retaining walls with counterforts in the storage building.

PERMANENT GANTRY CRANE and supplemental timber framing support movable forms of arch roof. Green concrete is covered by tarpaulins and heated by salamanders for cold-weather curing.



CRANE handles pair of concrete carts between mixing plant and runway.

Structural Design — Lone Star's engineering department designed the buildings; the detailed plans were prepared by the M. A. Long Co. The storage building is 75 ft. wide, 114 ft. long and 76 ft. high from top of footings to crown of the arch roof. An expansion joint divides the building into two sections 49 ft. and 65 ft. long. Storage space is formed by retaining walls 25 ft. high.

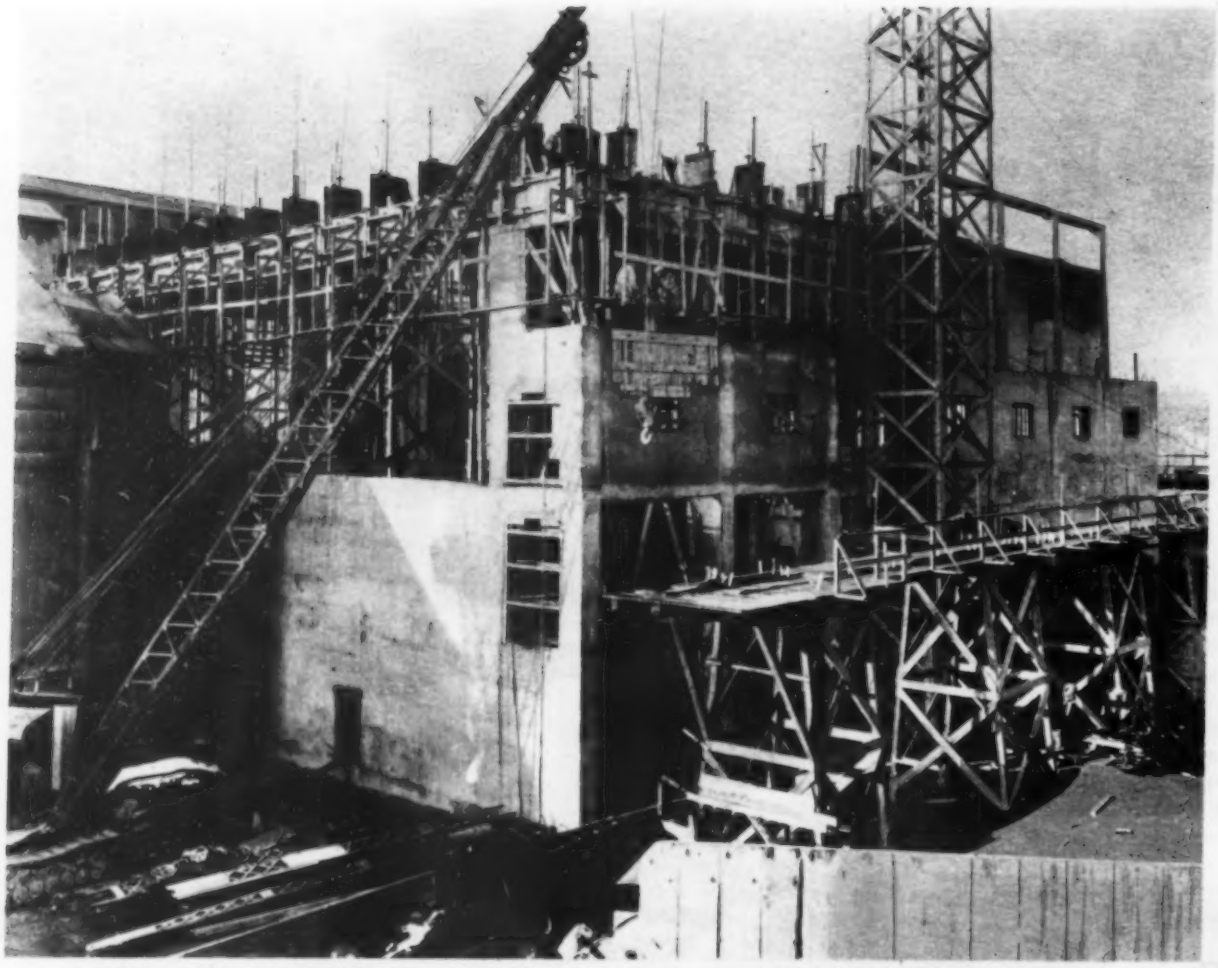
A belt-conveyor tunnel forms an integral part of the north retaining wall. East and west inclosures are counterfort retaining walls, with counterforts spaced at 16-ft. intervals. Counterfort columns are carried above the retaining walls to support the crane beams and the concrete roof. An inclined conveyor gallery forms part of the east wall. The south inclosure is a cantilever retaining wall.

Covering the storage building is a reinforced-concrete parabolic arch roof of 79-ft. span with a 16-ft. rise. Thickness of the roof is 6 in. at the crown and 12 in. at springing line. The eaves were figured as horizontal girders to take the thrust of the arch. They are supported by 20x24-in. columns every 16 ft., where two 2¼-in. tension rods pick up the total thrust. A sliding bearing is provided on east columns and a fixed bearing on west columns.

Construction—Economical construction of the rock storage building depended primarily on efficient handling of the form problem. The expansion joint which divides the building made it logical to erect the structure above the foundations in two sections. After foundations had been completed, the north part of the building was formed and placed. Stationary forms were used to the top of the cross tunnel and sliding forms from tunnel top to top of crane beam.

Placing of concrete in north section retaining walls started Oct. 19 and was completed Oct. 21. Portland cement was used to this point. Two days were required to change forms for columns and curtain walls of the superstructure. To speed completion of craneway girders and columns and beams of roof supports and permit work on the south section to begin at once, Incor 24-hr. cement was used in the superstructure. Forms were removed from roof support columns 4 hr. after concrete was placed, permitting the tops of girders to be troweled smooth. Forms from the craneway girder and beams were stripped within 24 hr. after concrete placing, and sliding form units were transferred immediately to the south section.

By using high-early-strength cement, the contractor saved a week to 10 days on this part of the job. After considering the advantages



SLIP FORMS build monolithic battered counterfort walls of rock storage building. North section of building has been completed up to roof beams, and crew is working on south section.

of high-early-strength cement, it was decided to use it on the entire south section, both because temperatures would be low and because concrete had to be placed against the expansion joint, a difficult operation if the concrete did not set properly. In both sections of the building, after reaching the elevation of the craneway girder, the contractor poured the girder, columns and beams monolithically.

Arch Roof — When work was completed to the roof support the contractor proceeded with parabolic arch-roof construction. Use of high-early-strength concrete in the craneway beams and roof-supporting beams made it possible to start roof construction without delay. Steel girders of the traveling crane were put in place as soon as the craneway beams were completed. A supporting tower was constructed under the crane girders to supplement them in carrying the form framework and green concrete, and a concrete hoist tower was built and connected with it. Both towers were on steel rollers.

Form segments previously cut and framed on the ground were erected on top of the crane girders. When roof forms were moved, the crane and tower traveled as a unit carrying the form with it. Forms were designed to place the roof in seven sections. A working platform was constructed to the elevation of the beams supporting the arched roof. Interference of tension rods and their supporting members made it necessary to construct the movable framework in three sections, so designed that hardwood wedges could be used to raise and lower the frame to required position.

Cold Weather Concreting — Protection from anticipated temperatures of 14 to 15 deg. F. was provided by tarpaulins attached to the forms, with flues leading from the salamander-heated working platform to the top of the forms where concrete was being placed. Concreting of the first section began Dec. 10. Although outside temperatures went as low as 10 deg. F., temperatures within the inclosure were never below 36 deg. during the roof construction and averaged 44 deg.

Cost of heat protection, including fuel and fire-tending labor, amounted to $15 a day. Use of high-early-strength cement saved 49 days in roof construction, or $735 in labor for heat protection.

Stripping times were determined by control cylinders poured with each section. Concrete strengths were closely checked by cylinder tests, and in every instance but one it was possible to move forms forward for the next section within 2 days of pouring.

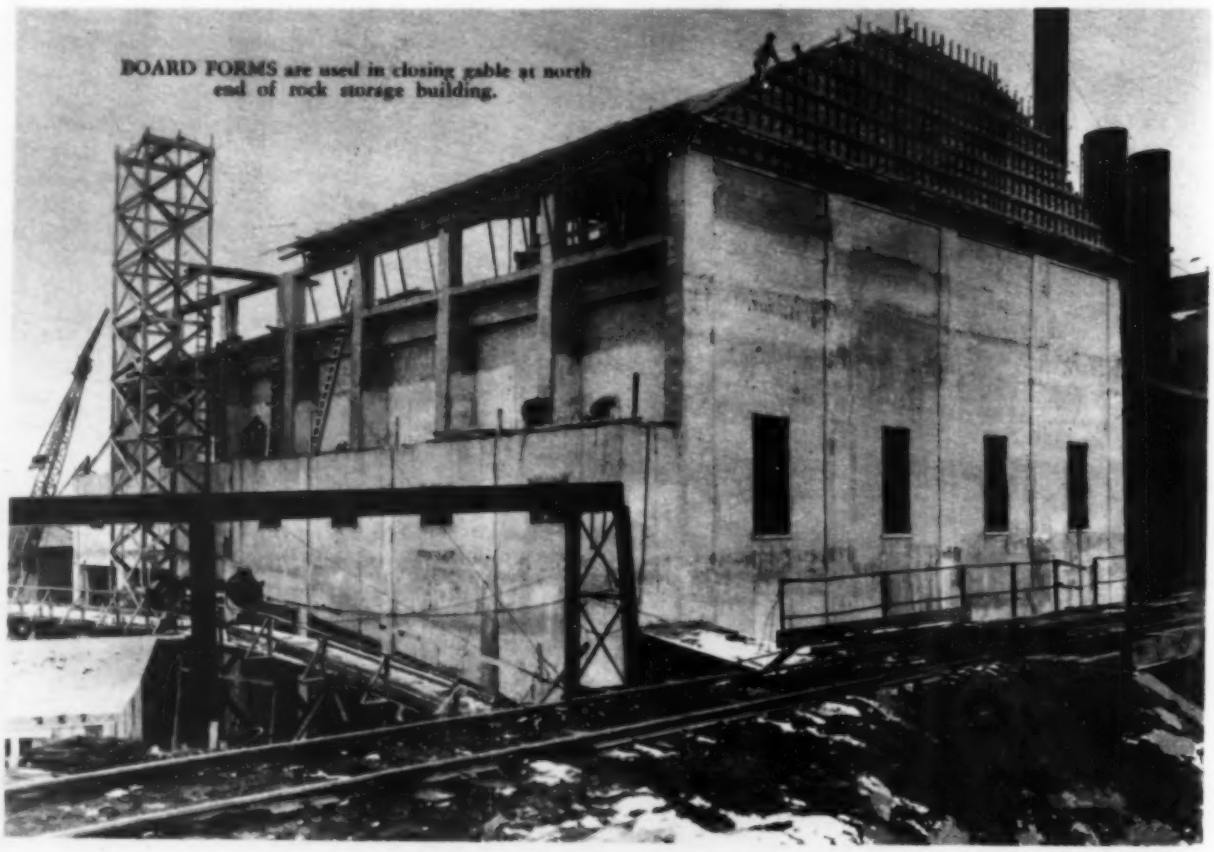
Concrete Mixtures — Concrete specifications for the heavy substructure called for minimum cement content of 5¼ bags per cubic yard, with maximum water content of 7½ gal. per bag. Concrete for roof contained a minimum of 6 bags of high-early-strength cement per cubic yard, with 6½ gal. of water per bag.

Trial mixes, proportioned by weight, resulted in following batch proportions:

	Mix Heavy Walls	Mix for Thin Walls	"Incor" Mix for Roof
Cement, lb.	376	423	470
Sand, lb.	880	880	800
Gravel, lb.	1,520	1,520	1,750
Cement, bags per cubic yard	5¼	5¾	6.15

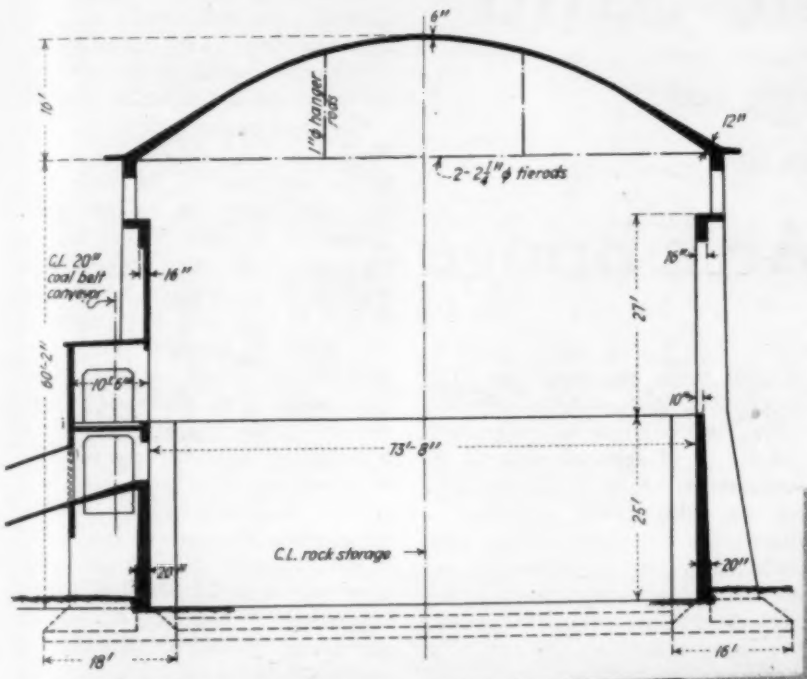
Concrete was batched by volume, the batching hopper being calibrated to the above weights.

Mixing and Placing — A Ransome mixer, ¾-yd. capacity, drum revolving 18 r.p.m., was used, each batch being mixed 2 min. minimum. Placing con-



BOARD FORMS are used in closing gable at north end of rock storage building.

TWO CONCRETE BUILDINGS for rock storage (at left) and rock crushing (at right) are completed on fast schedule during cold weather. Thin parabolic arch roof (6 in. thick at crown) of 79-ft. span rests on counterfort columns 16 ft. o.c.

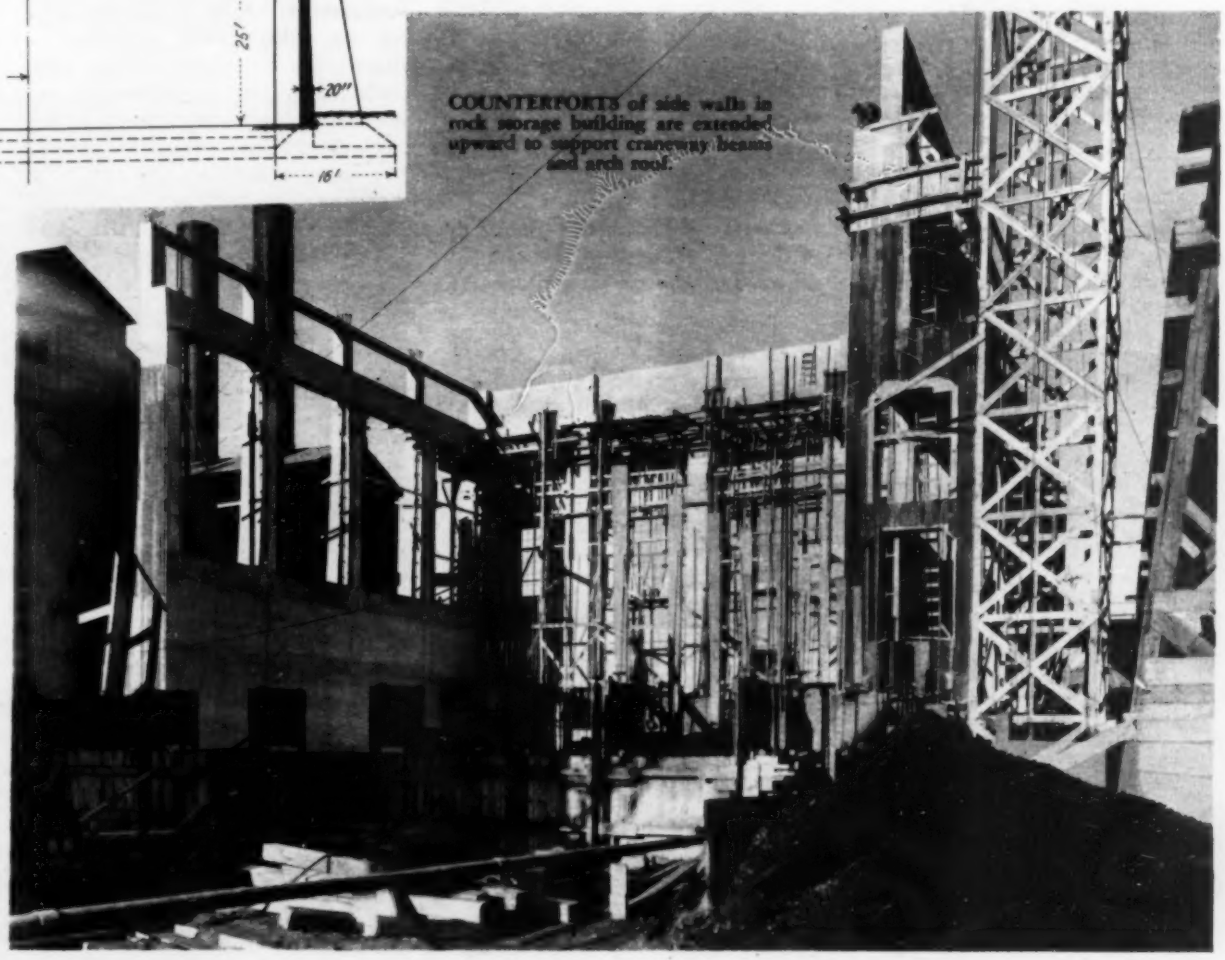


CROSS-SECTION of rock storage building shows thin arch roof and craneway beams supported by counterfort columns. Inclined rock conveyor tunnel from crusher building enters east wall (at left) under coal conveyor tunnel.

crete presented no unusual problems and was handled in the customary manner. No chuting was permitted, with the exception of the storage building's northwest gable wall. Concrete was transported directly to final resting place, where it was spaded and rodded. The slip-form method permitted use of relatively dry concrete placed in shallow layers. No segregation of materials was noted, and concrete free from honeycomb was obtained throughout. On slip form units a finisher's scaffold was attached to the moving form, and concrete was finished off as slip forms were raised.

In pouring the roof, a shallow layer of 4-in. slump concrete was deposited first to embed fully the bottom reinforcing of the arch and avoid any honeycomb on the underside of the roof. This first layer was followed by stiffer concrete of 1½-in. to 2½-in. slump. Concreting was done simultaneously from the eaves on both sides toward the center of the roof. At the steep part of roof, 1-in. slump concrete was used. Despite low slumps, the high-early-strength mix was readily workable.

Rock Crusher Building — Ordinary portland cement was used in construction of the crusher building, which was built with slip forms. Inserts at various floor levels provided the required bearing for the floors, which were poured after the walls were erected. Steel sash windows were set into place and concrete poured around them. The slip forms were used from top of subbasement to roof, for a height of 48 ft. Pouring began Sept. 23, and the top of the walls was reached Dec. 26. Instead of the 1:2:4 mix formerly used by the contractor in such work, a 5¾-bag mix using well proportioned aggregate was designed and proved eminently successful, as indicated by the progress of the slip form of 16 ft. per day.



COUNTERFORTS of side walls in rock storage building are extended upward to support craneway beams and arch roof.

STONE-FACED CONCRETE BRIDGE comprising six three-rib arches replaces old steel structure crossing Scioto River at Dublin, Ohio.

Limestone Sand

For Concrete and Mortar in

Stone-Faced Arch Bridge

WASHED LIMESTONE sand and crushed limestone rock furnished the inert ingredients for 5,740 cu.yd. of concrete placed in plain foundations and reinforced superstructure of a multiple-arch bridge built across the Scioto River at Dublin, Ohio, for the State Department of Highways by E. Elford & Son, of Columbus, contractors. A veneer of rock-face broken ashlar taken from the same Columbus limestone stratum that supplied the concrete aggregates was applied to arch rings, spandrels, piers and abutments. The broken courses of ashlar facing were tied to the concrete structure by bent rods embedded in the mortar and hooked at their inner ends around vertical bars anchored to the concrete masonry.

A fine limestone sand also was used in the masonry mortar for the stone facing. This mortar consisted of one part cement by volume, two and one-half parts of limestone sand by volume and 10 per cent by weight of hydrated lime, the percentage of lime being based on weight of cement.

Forms for all exposed concrete surfaces were lined with fiber board, with filled joints between the fiber-board panels to give a uniformly smooth concrete surface. Specifications required that most of the exposed surfaces (about 5,200 sq.yd.) be sandblasted lightly to give them a color and texture similar to the facing stone. Concrete had to be in place 3 weeks prior to sandblasting.

New Bridge — Replacing an adjacent steel deck truss bridge which was demolished after the present structure had been completed, the new bridge carries a 32-ft. roadway and two 3½-ft. sidewalks on six three-rib concrete arches. Two 100-ft. central spans (c. to c. of piers) are flanked by 95-ft. intermediate spans and by 72-ft. end spans. Total length of the bridge, from end to end of approach slabs on the abutments, is 590.66 ft. The bid items for the bridge itself amounted to slightly less than $200,000, but additional items for the approaches and lower roadway passing through an end span increased the value of the contract to more than $272,000.

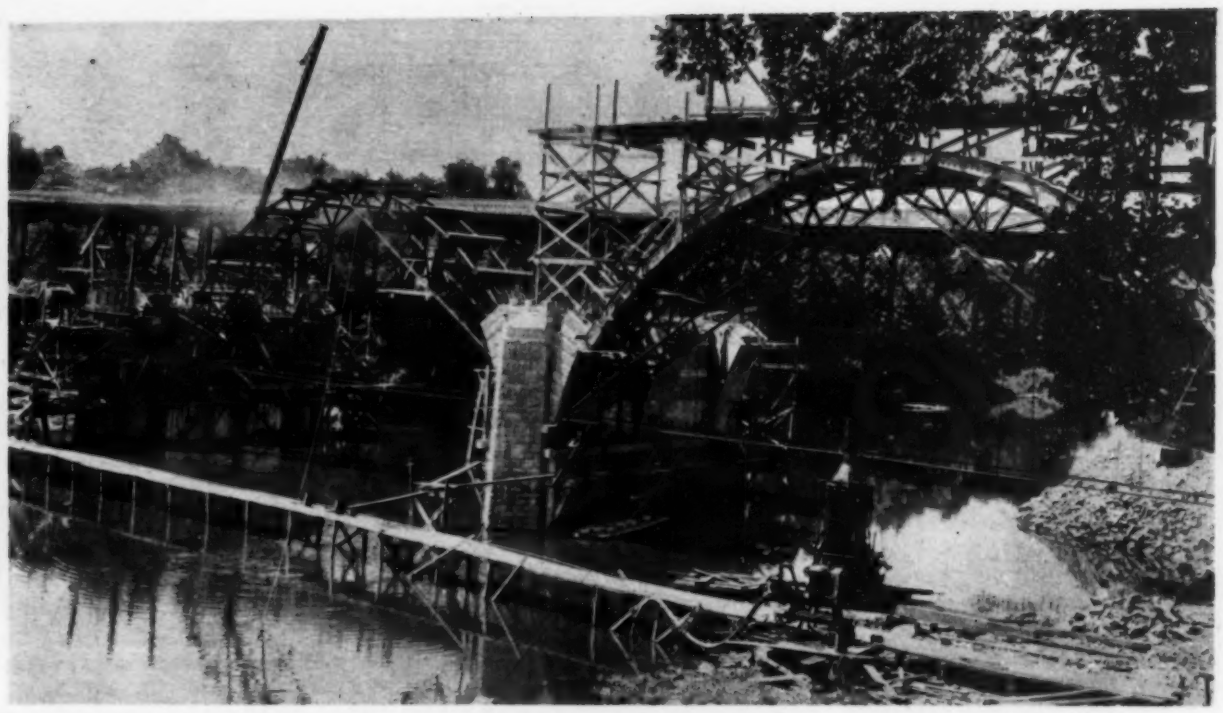
Construction — Only 1,000 cu.yd. of common excavation and 675 cu.yd. of rock excavation were required to place all foundations on rock. Construction started at the east end, operations being arranged to reduce to a minimum the interruption to traffic caused by removing the old bridge and opening the new one at the west end, where the two structures intersect.

Four steel centers built by the C. E. Morris Co., of Columbus, were used by the contractor for the main spans and wood centers for the end spans. Centers for an entire line of six ribs were erected at a time. Specifications required that no concrete be placed in an arch rib until arch ring stones had been placed on adjacent spans. To relieve initial stresses in arch stones, open joints with hardwood wedges were left in the ring at the crown and at designated points between voussoirs, or rib sections. The open joints were carefully filled with mortar just before the abutting rib concrete was placed. Wood wedges on the back face of the stone were replaced with lead wedges immediately before the rib concrete was placed, and the wood wedges on the outside face were removed just be-

CENTERS for entire line of six arch ribs are erected before any rib concrete is placed. Steel centers support four central spans; wood centers are used in end spans.

DETAIL of broken ashlar limestone facing on bridge pylon.

MOBILE STIFF-LEG DERRICK speeds work for stone setters.



STEEL CENTERS rest on timber pile bents. After being struck under completed rib, they are moved into position for concreting next rib.

fore the concrete took its initial set. Centering under an arch rib was not released until the arch ribs on adjoining spans had been in place at least 7 days.

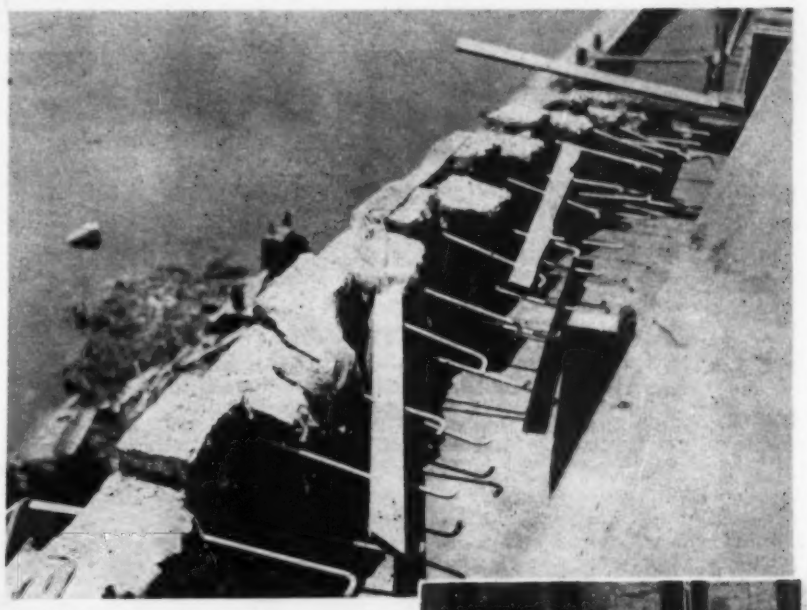
Centers were moved from one rib to the next on 6-in. pipe rollers laid on 12x12-in. timbers. The centers were drawn forward by hauling lines reeved to hand winches.

Concrete—Four-bag batches of nominal 1-5½ concrete were mixed by a 21-S mixer at the base of a tower alongside the lower roadway adjacent to the east end span. A tower bucket raised the concrete to a deck hopper from which the material was distributed by hand carts. All concrete was vibrated internally by mechanical vibrators. A nominal 1-6½ mixture was used in pier footings.

Progress — Work at the site started March 25, 1935, following the award of the contract on March 8. The bridge was completed, save for some cleaning up and landscaping, and was opened to traffic on Jan. 2, 1936.

Direction — J. J. Jaster, Jr., is director of the Ohio Department of Highways, Elmer Hilty is chief engineer of construction, and J. R. Burkey is chief bridge engineer. At the site of the work, the department was represented by Richard Orth, bridge engineer, and W. M. Seeds, assistant bridge engineer. For E. Elford & Son, the contractors, C. M. Brooker was in charge of construction.

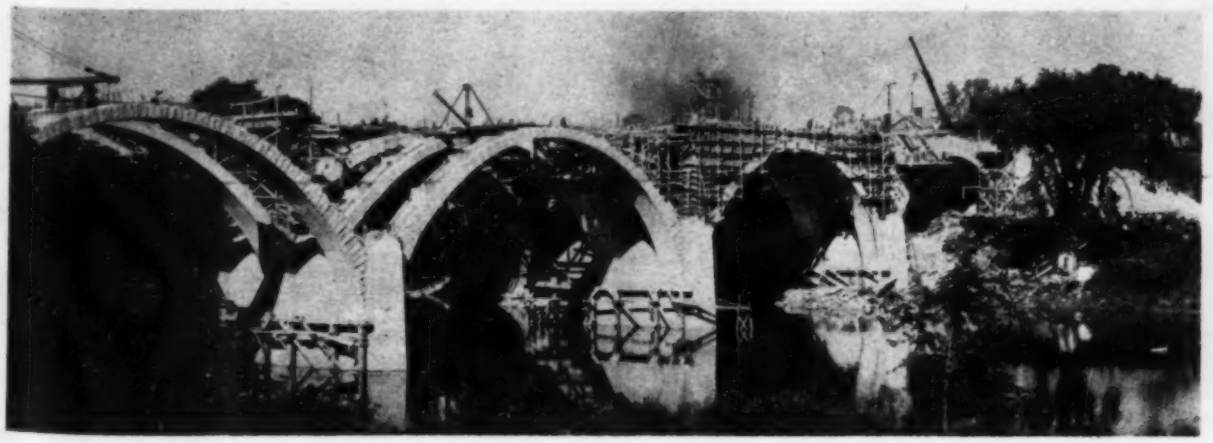
ROADWAY passes under arch at east end of bridge. Sandblasting of arch rib soffit is in progress at abutment.



BEFORE PLACING CONCRETE on arch forms of outside rib, workmen set ring stone with anchor rods in joints.

RING STONE *(below)* **is anchored to arches when rib concrete is placed.**

FACING STONE for all portions of structure except arch ribs is tied by hooked anchor rods to vertical bars of steel ladders firmly doweled to concrete masonry.



JOB ODDITIES

A MONTHLY PAGE OF

Unusual Features of Construction

COMPARATIVE SIZE

of 16-ft. reinforced-concrete conduit on cut-and-cover section of Colorado River aqueduct is indicated by Marjory Gage, 5-ft. 2-in. film actress, standing on top of arch.

STILL GOING STRONG

in Kentucky, oxen pull scrapers used in excavating foundation for new high school at Whitley City.

THIRTEEN TONS OF TNT

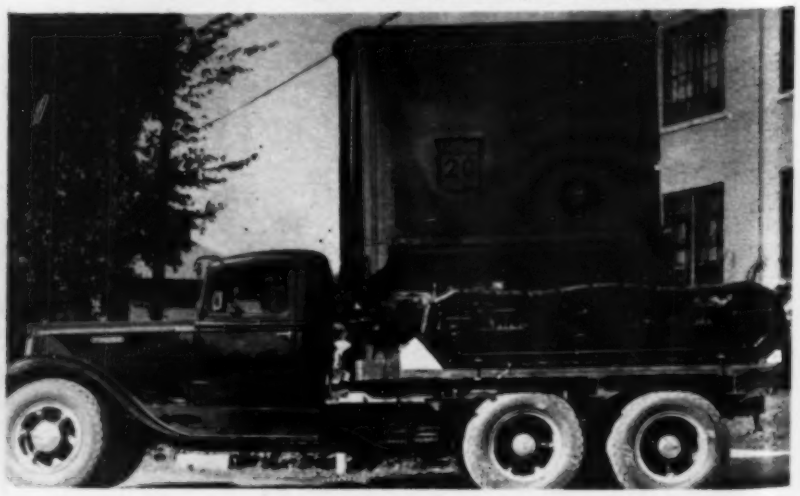
(right) shatter rock in range of small hills in southern California on route of All-American canal, begun 2 years ago by U. S. Bureau of Reclamation as part of Public Works program and now half completed.

HUGE GRANITE CORE

measuring 36 in. in diameter and removed by Calyx drill from deep exploratory hole in foundation of Grand Coulee dam on Columbia River in Washington, is dedicated with appropriate ceremonies at Washington State College, where F. A. Banks, construction engineer in charge of project for U. S. Bureau of Reclamation, delivered main address. Watching Miss Thornton, daughter of G. E. Thornton, professor of electrical engineering at Washington State College, smash bottle on granite shaft, are: *(left to right)* Dean H. V. Carpenter, College of Engineering; A. F. Darland, field engineer, Bureau of Reclamation; E. O. Holland, president, Washington State College; F. A. Banks, construction engineer, Bureau of Reclamation; Miss Thornton; Professor Thornton; and Hon. C. D. Martin, governor of Washington.

1,800-MI. HAUL

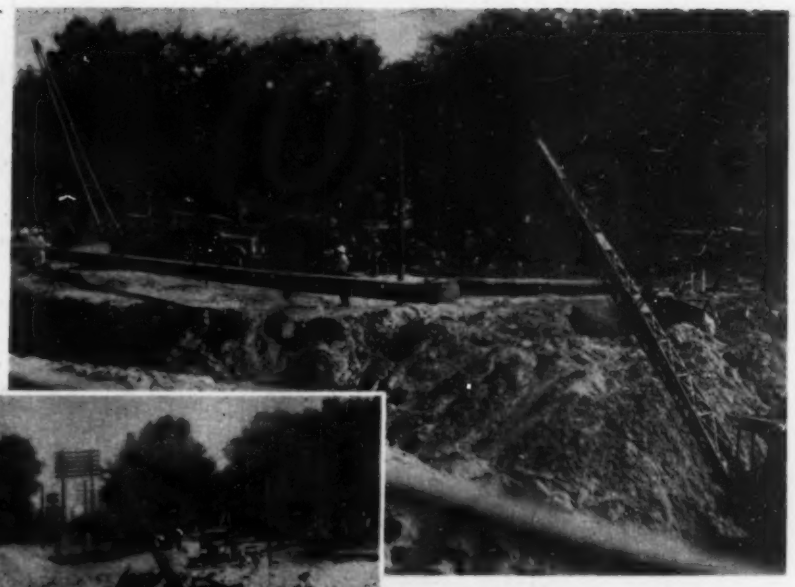
(below) for ⅜-yd. Bay City power shovel from Bay City, Mich., to Pony, Mont., takes 7 days and saves $400 over railroad freight charges. Shovel manufacturer builds special frame on International 5-ton truck belonging to purchaser, H. R. & Co., of Pony, Mont., to carry safely load in excess of 10 tons. Truck carries shovel through muddy detours en route and near end of trip climbs 37 per cent grade for ¼ mi.



Clamshell Dredging

Sinks Welded Water Main in Sandy River Bottom

IN CARRYING a new water main across a river in Oklahoma City, Okla., the Sherman Machine & Iron Works, contractor, under the direction of T. G. Banks, superintendent and engineer of the City Water Department, welded a 300-ft. length of 20-in. Armco spiral-welded pipe, drew the pipe into position across the river, and sank it to grade in the sand bed of the stream by excavating alongside with a clamshell bucket after the pipe had been filled with water. Welded caps on the two ends of the 300-ft. pipe were fitted with 2-in. taps to permit filling the line with water. The pipe is anchored by chains to creosoted timber piling driven to shale.



1 300-FT. LENGTH of 20-in. pipe at river crossing is welded into one piece, with 2-in. pipe taps in welded caps at two ends of unit.

2 WELDED PIPE is pulled across river beside trench excavated to water level in both banks.

3 WITH PIPE IN POSITION *(left)*, line is loaded with water to aid settlement as crane excavates sand alongside main.

Including connections on both sides of the stream, the river crossing required 1,140 ft. of spiral-welded 20-in. pipe, forming part of a main constructed to furnish better water pressure in Capitol Hill, the southern part of Oklahoma City. The entire main comprises, in addition to the river crossing, ½ mi. of 30-in. and 2 mi. of 20-in. cast-iron pipe, 1 mi. of 18-in. spiral-welded pipe, ¼ mi. of 16-in. and about ½ mi. of 12-in.

Improved construction of the new main at the river crossing is expected to eliminate frequent breaks in the line, caused by high water at this point, which have given trouble with two 12-in. lines previously in service. A plan is contemplated to consolidate the two 12-in. lines in a single 16-in. line, which will be placed in a manner similar to the 20-in. main.

A crane equipped with a ¾-yd. clamshell bucket excavated the trench and handled the pipe at the river crossing, assisted in the latter operation by a winch truck. At the same site, the county constructed a new approach to the highway bridge with WPA forces. The piledriver in Photograph 3 is engaged in this approach work.

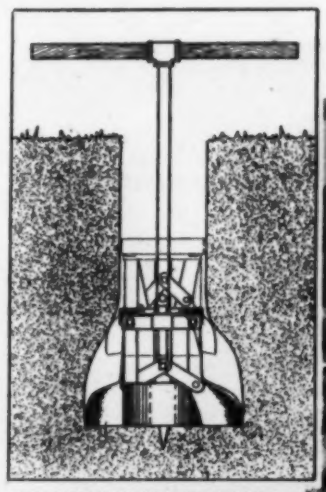
For the Sherman Machine & Iron Works, operations were directed by S. C. Clark, engineer, who appears in straw hat and shirt sleeves to the left of the pipe line in Photograph 3. Data for the accompanying notes were furnished by Mr. Banks, superintendent and engineer, Oklahoma City Water Department.

Expanding Reamer

Bells Out Holes for Footings

AN INSTRUMENT developed and patented by Roy Cramer, of Dallas, Tex., is used by Cramer & Co.'s crews to excavate bell-shaped enlargements at the bottoms of post holes, providing three times the footing area for foundation piers without any increase in the diameters above the bells. Known as a foundation underreamer, the device operates by expanding to twice the diameter of the hole after it has been lowered to the bottom and by contracting to carry each load of excavated earth to the surface. The reamer is operated by hand, but a power-driven auger is often used to dig the post holes. According to Mr. Cramer, the reamer will work in holes of any depth. Thousands of foundations in Texas have made use of the device, and foundation footings of this type are shown on most Dallas plans. The reamer dug the footings for the first building erected at the Texas exposition, held last year in Dallas.

By a consistent advertising campaign utilizing radio, newspapers, periodicals, billboards and direct mail, Roy Cramer keeps three estimating salesmen and a fleet of twenty trucks busy—in addition to other special equipment such as the auger and reamers.



FOUNDATION REAMER for enlarging bottoms of post holes *(above)* triples bearing area without increasing size of bore. Device contracts *(right)* to remove load of spoil to surface.

FOUR BINS for cement (at near end) and three sizes of aggregate are spaced along railroad siding to provide space for track storage of one day's materials requirements.

1,000-Ft. Railroad Set-Up Cuts Cost of

Material Handling

on Concrete Paving Job

By FRED C. TODD

The Andrews Asphalt Paving Co., Hamilton, Ohio

AGGREGATE BINS are loaded by bucket conveyors directly from track hoppers. One operator at each bin weighs aggregate and runs elevator.

CLOSE TO THE center of two adjoining contracts at Fortville, Ind., involving altogether about 12 mi. of 20- and 30-ft. concrete pavement, the Andrews Asphalt Paving Co., of Hamilton, Ohio, contractor for the Indiana Highway Commission, last summer utilized a parallel railroad passing track to set up an efficient batching plant designed for track storage of each day's material requirements and for direct loading of aggregate and cement bins by elevators from track hoppers. A straight drive-through for batch trucks under three aggregate bins and a cement bin reduced the batch-loading time to a minimum, and simplicity of the plant cut down both the investment in material-handling equipment and the cost of labor for daily operation.

An old road 18 ft. wide paralleled the new highway and lay about midway between it and the passing track at the batching plant, as indicated by the accompanying sketch. Specifications required the use of two sizes of coarse aggregate and one of fine aggregate. Three aggregate bins of 65-ton capacity were spaced to permit car storage of materials for a full day's run of one 1-yd. paver, and a bulk cement plant was placed at the upper end of the site.

Job Planning—Original plans for the work contemplated simultaneous operation of two paving units. A single batching plant to feed the two units appeared to offer economies, but ordinary methods of crane unloading and stockpiling would never have sufficed to supply two outfits requiring 2,000 tons of aggregate per day. After thorough study, a system of unloading from track hoppers to bins by bucket conveyors was designed. Although the job actually never required the operation of two paving units, the plant proved economical for one paver and showed ample capacity to supply two units if necessary.

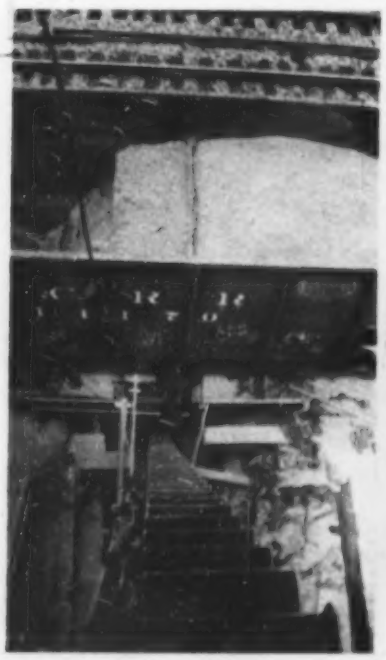
Quantities — For the entire job, involving 160,000 sq.yd. of concrete pavement, the batching plant handled 48,000 bbl. of cement, 16,000 tons of coarse gravel, 22,000 tons of small gravel and 21,000 tons of sand. Expressed in railroad carloads, the work required 120 cars of cement and 1,000 cars of aggregate.

To load the plant for a day's run required two hopper cars of cement (800 bbl.), five cars of coarse gravel, six cars of small gravel and six cars of sand. To supply a single paver, one switch a day was sufficient. This switching was done about 7 a.m., while the plant was in operation, but the bins had ample capacity to carry the plant through the 30-min. switching period. To handle twice the daily output, two switchings would have been required, with two additional ground men to take care of the extra work.

Plant Operation — Cars containing each size of aggregate were kept coupled in a unit. As a car was emptied, the unit was moved forward to put the next car into position for unloading. The contractor used car-movers for short pocket moves and a 30-hp tractor for long moves. As a car of sand was emptied, all six cars were moved down, thus making space for an empty car of small gravel, and so on for the cars of coarse gravel and cement.

Aggregate hoppers of sheet steel were built under the track with doors operated by levers from above, permitting the operator to regulate the amount feeding into the buckets. The buckets were 12 in. wide and were mounted on a 14-in. belt carried by a timber frame and driven through gear reduction boxes at the top by 10-hp. three-phase 220-volt motors. Starting boxes, placed at the ground for convenience, had cords running to the bin platforms to enable the men to pull the switches at any sign of trouble.

Production — Specifications permitted a batch 1.1 cu.yd., but the mixing cycle limited the output to a maximum of 45 batches per hour, or 540 batches for a 12-hr. run. Sand and small gravel

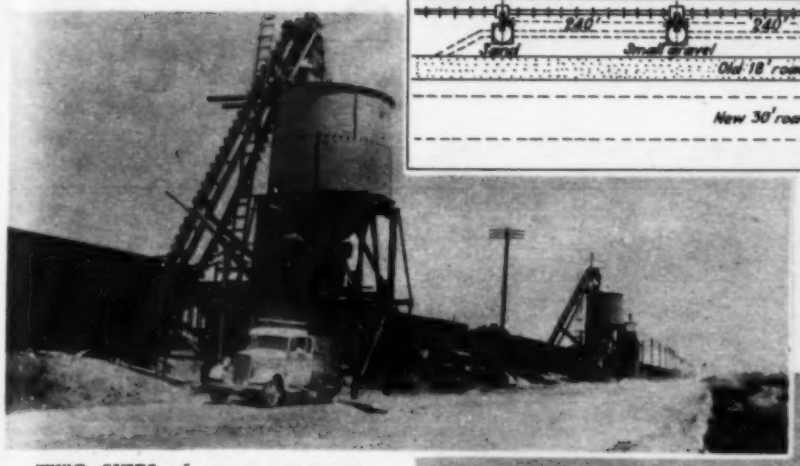


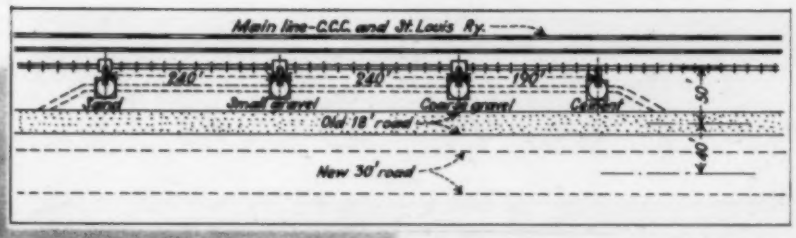
HOPPER CAR discharges sand into track hopper from which bucket elevator raises material to overhead steel bin.

STRAIGHT DRIVE - THROUGH for trucks under series of four overhead batchers eliminates time loss in loading.

EACH AGGREGATE BIN is equipped with hopper and scale for weight batching of material, fed by gravity from above.

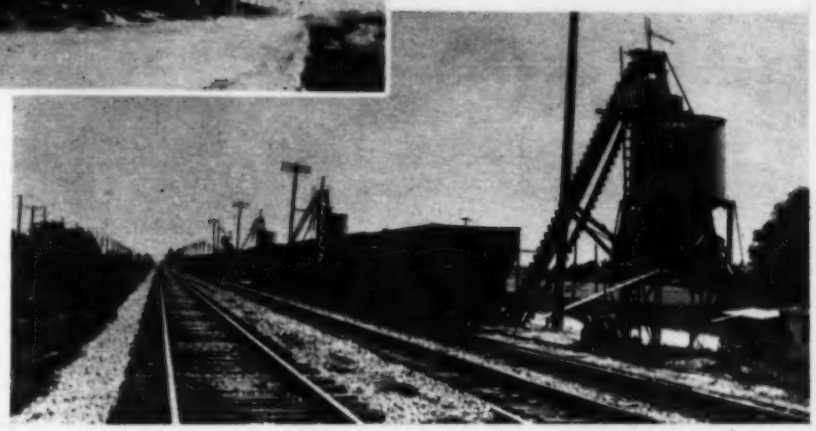
DRIVE UNIT at top of bucket elevator consists of 10-hp. electric motor (in wooden box), gear reduction box and drive chain.



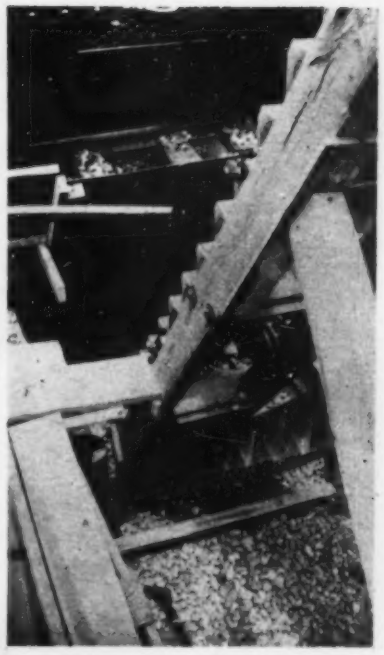


PASSING TRACK parallel with old and new roads affords ideal site for efficient material handling layout at center of 12-mi. job. For worst loading condition, with aggregates delivered in 40-ft. cars holding 50 tons each, plant has capacity of 500 batches for 11-hr. run, 1,180 ft. of 20-ft. paving.

TWO SIZES of coarse aggregate are batched at separate bins. Truck is under bin holding small gravel.



TRACK LOADED to capacity for full day's run, requiring 1,000 tons of aggregate and 900 bbl. of cement. Sand bin is in right foreground.



TRACK HOPPER of sheet steel is equipped with gates operated by lever from above to regulate flow of material.

were used in almost equal quantity, about 1,400 lb. of each per batch, with about 1,000 lb. of coarse gravel. A full day's run of 540 batches required 354 tons of sand, 394 tons of small gravel, 263 tons of coarse gravel and 891 bbl. of cement. Cars varied in contents, but the small cars averaged about 60 tons, giving ample loading for a day's run.

Labor Requirements — Operation of the plant for one paving unit required one foreman, one skilled man on the cement plant and six laborers. The foreman operated the tractor and supervised the general operation. At the cement plant the skilled operator ran the plant and weighed cement. A laborer took care of cement unloading. At each gravel bin one man did both the weighing and unloading with occasional assistance of the foreman on the ground. On the sand bin the batcher man made out batch tickets and operated the bucket elevator. One or two men were needed in the sand cars to help unload this material, depending on the moisture content. For handling aggregates, 12 hr. foreman time and 60 hr. common labor took care of the output for a 12-hr. day, amounting to about 1,000 tons of sand and gravel. As common labor could be obtained in this locality for about one-third the rate of a good crane operator, the economy of the bucket elevators is obvious.

Truck Loading and Hauling — One of the most appreciated features of the set-up was its ample capacity to load the trucks. A two-batch truck moved through the entire plant in 3 min. Fords and Chevrolets equipped with Blaw-Knox cement boxes were used for hauling.

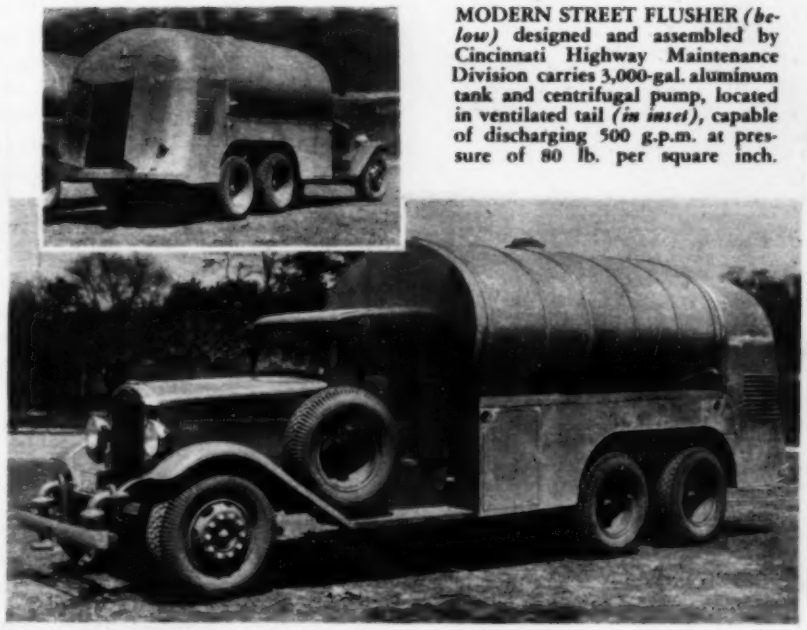
Each batch weighed 4,400 lb. With sideboards, middle batch board and cement boxes the total load on a truck amounted to 5 tons. On the longest haul of 7 mi. the trucks were able to make a round trip in 45 min. This haul required seventeen trucks. On the shortest hauls, the number of trucks was reduced to five.

Plant Equipment—Bucket conveyors were assembled by the contractor, using Link-Belt buckets, idlers and driving mechanism with belting from the Cincinnati Rubber Co. The cement plant was a Blaw-Knox unit of 130-bbl. capacity, and the aggregate bins also were Blaw-Knox, of 65-ton capacity.

Economies — In addition to low labor costs, the power costs for operating the plant were so low as to be almost negligible when compared with the cost of fuel for unloading by crane and clamshell. Repair costs were proportionately small. The investment in the elevators as compared with other unloading equipment was highly favorable and was the deciding factor in the adoption of the set-up. A permanent advantage of the plant is its mobility, requiring only a crane for loading or unloading and setting up. If a crane is not available, one can be obtained from the railroad at a reasonable rental.

Aluminum Street Flusher Shows Results of Specialized Design

WITH CHASSIS, tanks and pumping units produced by separate manufacturers in accordance with plans and specifications furnished by the Cincinnati Division of Highway Maintenance, three new street flushers designed and assembled by this division of the city's Public Works Department have shown unusual effectiveness as cleaning agents, pumping water in volumes up to 500 g.p.m. at a pressure of 80 lb. per square inch. On a chassis constructed entirely of standard parts and powered with a 114-hp. six-cylinder gasoline engine is mounted an all-aluminum tank 11½ ft. long, of 3,000-gal. capacity. The tank is of elliptical cross-section 7 ft. 10 in. wide by 5 ft. 8½ in. high and has two longitudinal and four transverse surge plates to minimize surging. A one-way valve filler plug at the right rear of the tank can be opened only by fire plug water pressure.



MODERN STREET FLUSHER *(below)* designed and assembled by Cincinnati Highway Maintenance Division carries 3,000-gal. aluminum tank and centrifugal pump, located in ventilated tail *(in inset)*, capable of discharging 500 g.p.m. at pressure of 80 lb. per square inch.

A standard single-stage centrifugal end-suction pump with 5-in. intake and 4-in. discharge is housed with its 61-hp. V-8 gasoline driving motor in the ventilated aluminum tail, which is equipped with double doors. Water from the pumping unit is forced through copper tubing to four flushing nozzles individually air-controlled from the cab.

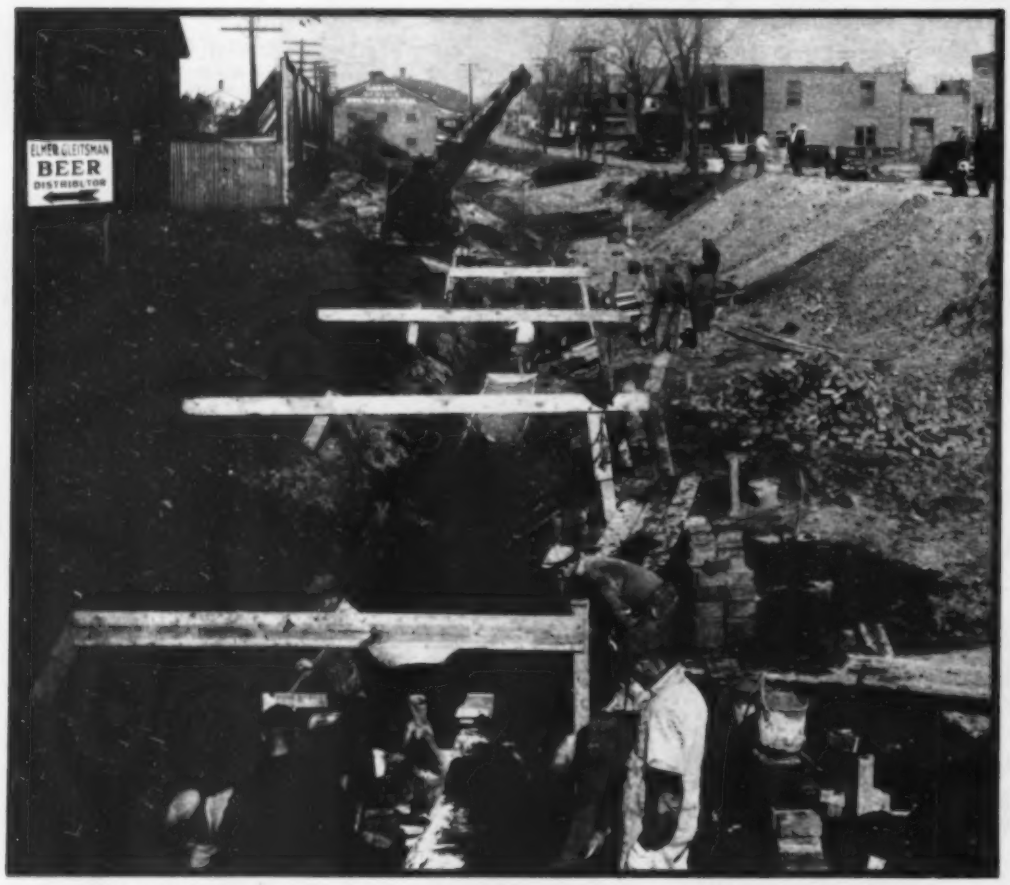
Overall dimensions of the new flushers are: length, 27 ft.; width, 8 ft.; height, 10¼ ft. According to Charles E. Brokaw, superintendent of the Highway Maintenance Division, who supplied the data for the accompanying notes, the use of all-aluminum tanks and fittings is expected to eliminate the rust and scale which have given trouble in street flushers of ordinary construction.

New Storm Sewer

Creates Income Producing Property

TEMPLETS set to line and grade guide construction of lower half of segmental block sewer. Outer ring is placed short distance ahead of liners.

IN CHARGE of sewer work *(right)*: H. T. Sutherland, superintendent of construction, Ohio Department of Public Works; C. E. Rice, city engineer, and Samuel Jones, assistant city engineer.



IN OPEN AREAS crane and clamshell excavate sewer trench, followed by placing of underdrain and cradle

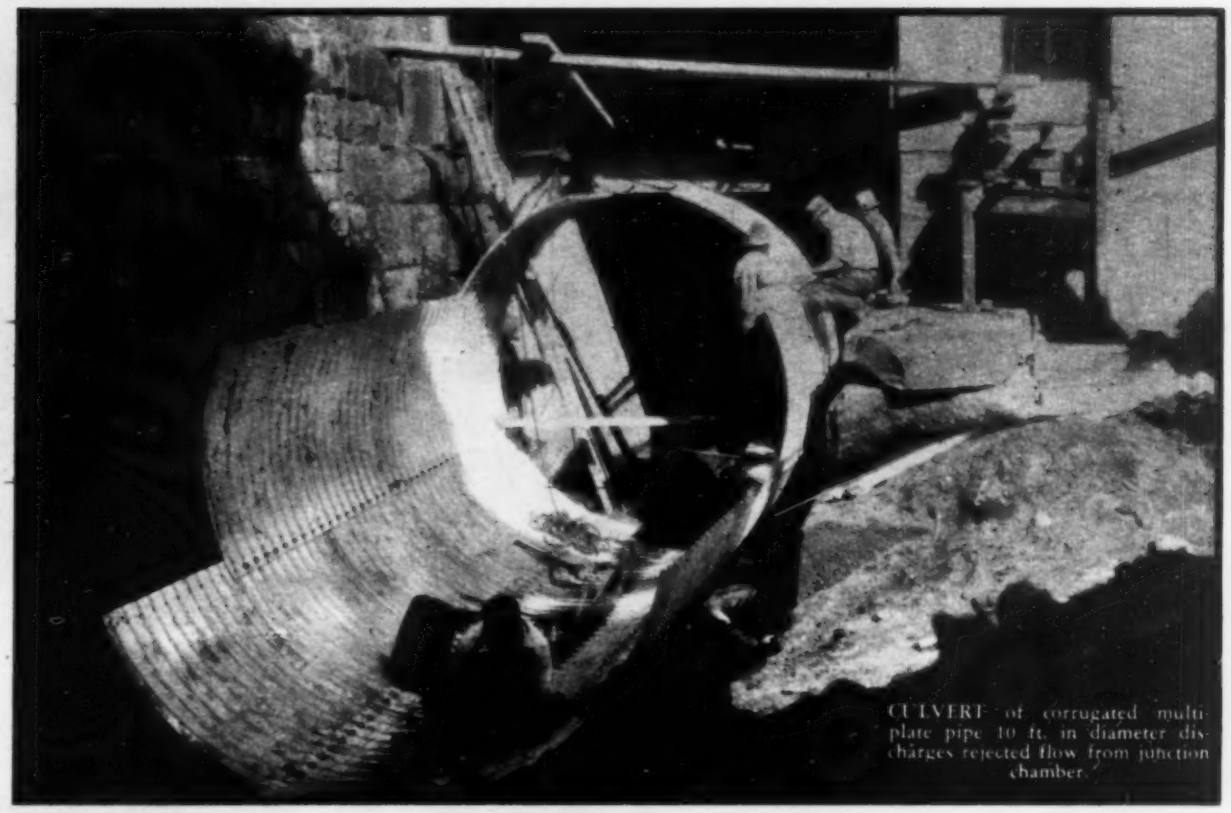
BY CONSTRUCTING more than a mile of intercepting storm sewer ranging from 1 to 6 ft. in diameter in the bed of an old canal running through the business section of Massillon, Ohio, the city corrected an unsanitary condition, improved the appearance and value of property in its central district, and provided useful work for a large number of its unemployed. The project was financed by a loan and grant from PWA and was built by the General Asphalt Paving Co., of Canton, Ohio, for a contract price of about $145,000. By an arrangement with the State of Ohio, which owns the canal right-of-way, the city is relieved of the cost of repaying the loan and eventually will earn some income from the property created by the improvement. Vitrified pipe, brick and segmental block construction were used in building the sewer. Junction chambers at two points divert a share of creek water into the sewer for the use of manufacturing plants downstream.

Description of Project—An unsanitary and unsightly condition was presented by the open channel of the Ohio Canal which paralleled the Tuscarawas River for ½ mi. through the business center of Massillon. The canal

had not been used for navigation for 30 years or longer. In that time about 50 per cent of the channel in the business section had been covered by buildings which paid rent to the State as the owner of the land. The remainder of the channel had been partially obstructed by old cofferdams and had been used as a receptacle for rubbish and garbage. In dry weather pools of stagnant water in the bed of the old canal were a serious health menace.

Both the river and the canal flow in a north-to-south direction through the city. The canal lies to the east of the river. A drainage area of 20,000 acres east of the canal discharged into the old open channel. This water supply is the best available for local industrial use. The city engineer for years had recommended construction of an intercepting sewer to replace the old canal and conserve the supply of useful water.

An intercepting sewer 5,572 ft. long was constructed in the bed of the canal. Including intake flumes and 918 ft. of sanitary sewer relaid in connection with the work, the contract involved a total of 6,966 lin.ft. of sewer. Specifications called for segmental block sewer for all sizes of 36-in. or greater. Because strikes at the block plants for 3 months prevented delivery of segmental blocks, a good part of the larger sewer sections were built of brick in order to keep men at work during this period. As actually constructed, the program embraced 1,460 ft. of double-strength vitrified pipe in 12-, 15-, 18-, and 24-in. sizes; 3,944 ft. of two-ring brick sewer in 36-, 48-, 54-, and 60-in. diameters; and 1,562 ft. of segmental-block construction in 36-, 42-, 60-, and 72-in. circular sections.



CULVERT of corrugated multi plate pipe 10 ft. in diameter discharges rejected flow from junction chamber.

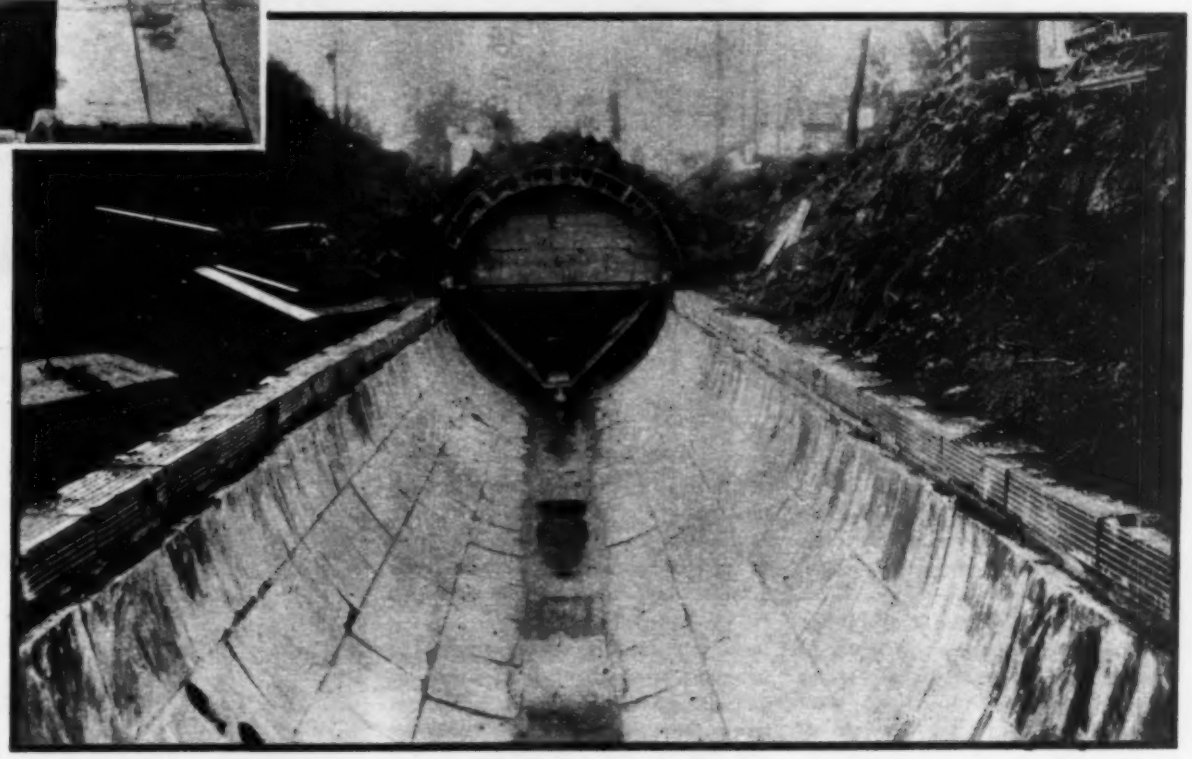
TWO-RING BRICK SEWER 4 ft. in diameter passes through area occupied by buildings.

Filling the old canal property made possible the removal of four bridges and the regrading, widening and paving of the city's streets at these points. In addition, two other streets which had been blocked by the ditch were opened across the canal property.

Sewer Construction — Where the canal bed was not obstructed by buildings the contractor excavated with a crane and clamshell bucket. Hand excavation originally had been specified for this operation. By permitting use of a mechanical excavator, the city obtained a credit of $5,000 on the contract price.

Underpinning of existing buildings and bridge abutments was the most laborious feature of the sewer work. Some building piers had to be moved. This operation involved the installation of needle beams or girders to support structural columns and the construction of new piers. A crew was continuously at work in the cellar of one building from April to September underpinning foundation walls and laying a new floor slab. All structures were underpinned to solid ground.

In constructing the sanitary sewer, which had to be lowered to a maximum depth of 17 ft. below street level to pass under the new intercepting storm sewer, the contractor drove



SEGMENTAL BLOCK SEWER utilizes smooth liners inside hollow tile outer ring. Arch forms support upper half of sewer during construction.

timber sheeting to retain the banks of the trench and excavated between the sheeted walls with a clamshell bucket. Earth to backfill a portion of the canal was obtained by leveling a mound on state property with a steam shovel. Total borrow backfill on the project amounted to 28,000 cu.yd.

At the discharge end of the sewer an old stone masonry lock had to be partially demolished to make way for the 72-in. segmental block drain. Pneumatic drills broke up the stonework.

Accompanying photographs illustrate the construction of the brick and segmental block sections. As the sewer was built on state property the design had to conform with a requirement by

PNEUMATIC TOOLS demolish stone masonry walls of old navigation lock at discharge end of storm sewer.

JUNCTION CHAMBER at head of 6-ft. diameter sewer section unites flows from 54-in. and 60-in. sewers.

GRAVEL UNDERDRAIN and concrete footing are placed in advance of sewer barrel. Clamshell bucket digs trench.

the Ohio Department of Public Works that the structure rest on a concrete footing. Timber templets set to line and grade guided the construction of the lower half of the sewer, and the upper half was laid up on semi-circular forms.

Junction Chambers—Designs of the two junction chambers are quite different. Junction chamber A, built of brick at the upstream end of the 72-in. segmental-block sewer section, is the simpler structure. A 54-in.-diameter brick sewer from the east discharges Wetmore Creek into the junction chamber, where it unites with the flow from a 60-in. sewer in the canal bed.

Junction Chamber B, a concrete structure farther upstream, serves a double purpose. To make the normal flow of soft water in Sippo Creek (draining from the east) available for industrial use in the southern part of the city, the junction chamber provides a 4-ft. by 2-ft. 10-in. rectangular weir channel which discharges into a 36-in. circular sewer at the downstream end of the junction chamber. At time of storms excess water from Sippo Creek overflows the weir wall into a large rectangular channel 7 ft. 8 in. by 5 ft. in dimensions. This channel discharges to the west through a 10-ft.-diameter Toncan multi-plate culvert and 900 ft. of paved invert in the existing creek bed leading to the river. The same discharge channel takes care of (1) the flow from a 60-in. sewer entering the upstream end of the junction chamber and (2) the flow from a reinforced-concrete box flume which carries the South Branch of Sippo Creek through the junction chamber under the weir channel. This flume replaces a former inverted siphon which conducted the South Branch under the canal.

Concrete construction involved in Junction Chamber B and other structures of the project amounted to 763 cu.yd. This masonry was built by the Massillon Construction & Realty Co. under subcontract.

Debt Retirement — For 15 years or longer, until the loan from the PWA is repaid, the city is permitted to collect the rents from all leases on canal property and to apply this income toward retirement of the debt. After the obligation has been liquidated, the city will continue to collect the rents and will retain a portion of them, turning over the balance to the state. This arrangement relieves the city of all expense in paying for the sewer and gives it a prospective source of new income in the future.

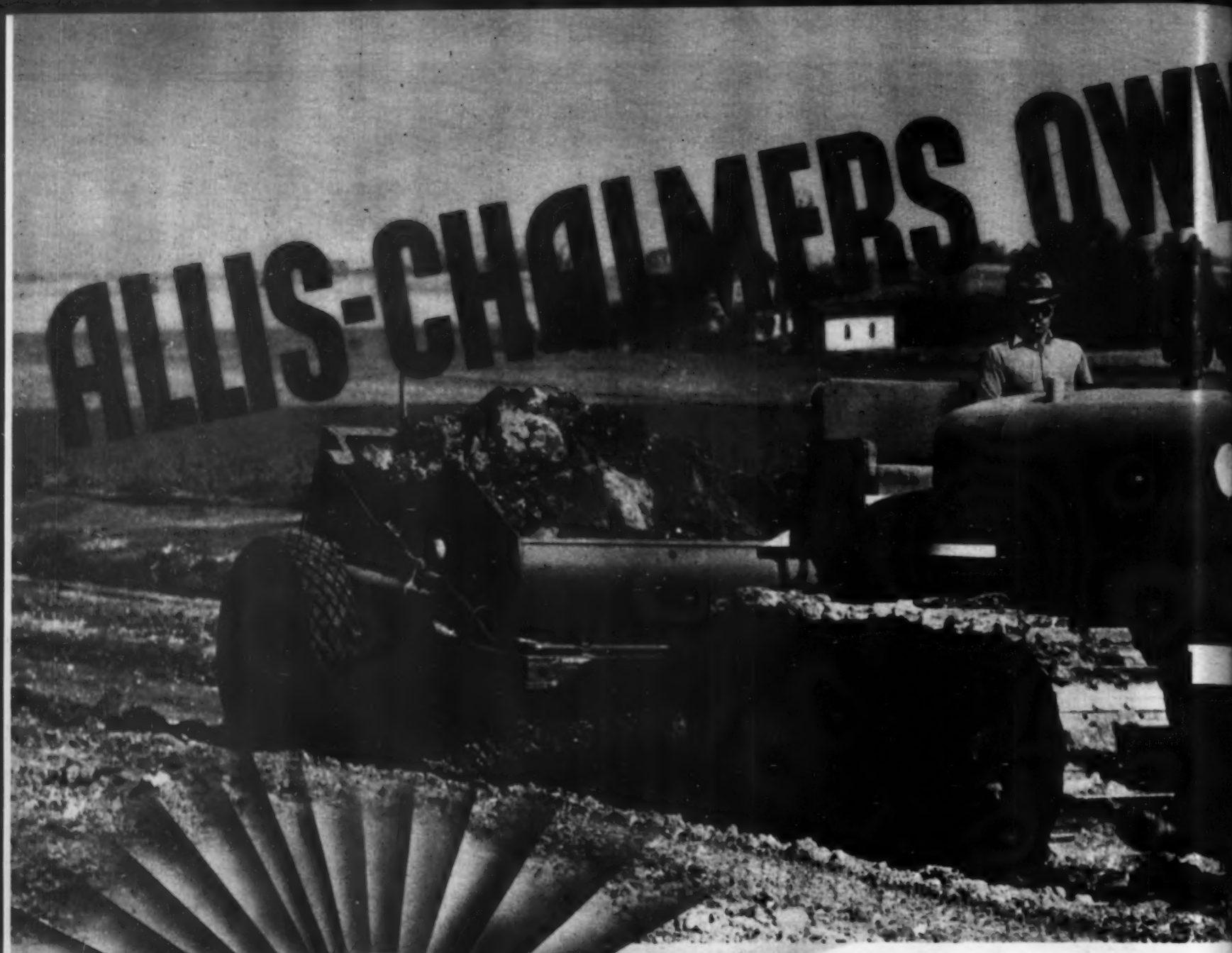
Administration — Design and construction of the sewer were carried out under the direction of C. E. Rice, city engineer. Samuel Jones is assistant city engineer. George Wallace acted as assistant engineer in charge of office work on the sewer project. For the Ohio Department of Public Works, H. T. Sutherland served as superintendent of construction under T. S. Brindle, director of public works, who passed on all plans for the improvement. E. E. Kinnison, engineer inspector, represented the Public Works Administration on the project, reporting to the office of L. A. Boulay, state engineer for PWA.

Operations of the General Asphalt Paving Co. were directed by A. W. Faber, general superintendent, and Julius Wittman, superintendent, under the broad supervision of Samuel F. Pace, president.

IMPROVED LAND VALUES result from replacing obsolete canal with new storm sewer and grading property.

Bonneville Dam Piers

COLUMBIA RIVER FLOW at site of Bonneville dam, 42 mi. upstream from Portland, Ore., is being passed through open bays in partially completed south half of main spillway dam (located in north channel between Bradford Island and Washington shore) during construction of north half. Columbia Construction Co., contractor, first inclosed south half in timber crib cofferdam and constructed foundation on bedrock at about El.-50, carrying gate sills up to El.-8 and extending narrow piers between openings above water level. South cofferdam then was removed and north cofferdam completed in readiness for June-July floods of 1936. Last fall contractor unwatered north cofferdam and began placing concrete in this portion of spillway dam. Contract, being executed under direction of Corps of Engineers, U. S. Army, will amount to about $11,500,000, largest single item to be met from initial PWA allotment of $32,440,700 for this power and navigation development. Elsewhere in this issue appears description of construction operations on power house and lock in Bradford Slough, between Bradford Island and Oregon shore.



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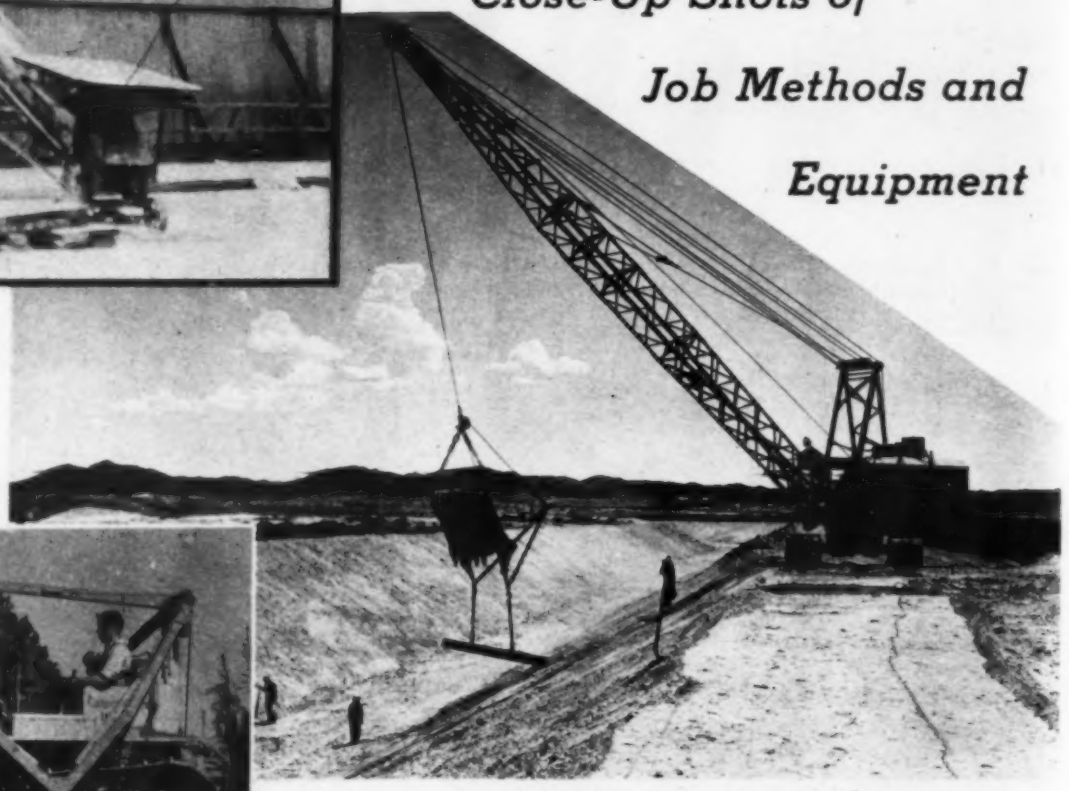
Controlled Ignition

Getting Down to DETAILS

Close-Up Shots of Job Methods and Equipment

PORTABLE BELT CONVEYOR

handles wet concrete from truck mixer to forms on elevated highway job in New York City. Portable Machinery Co. 24-in. by 60-ft. unit is made up of standard sections permitting shortening or lengthening. Conveyor can be detached from elevating wheel truck for horizontal service.



DETACHABLE STEEL BAR

on 2½-yd. dragline smooths side slopes after machine has trimmed canal section to line and grade on main canal of Gila reclamation project north of Yuma, Ariz. J. H. Boyce & Sons Co. & Roy L. Igo, of Baton Rouge, La., contractors for canal excavation, rough out canal with 5- and 6-cu.yd. dragline buckets and finish trimming and smoothing with lighter excavator. R. B. Williams is construction engineer in charge of work for U. S. Bureau of Reclamation.

TRACTOR-BULLDOZER

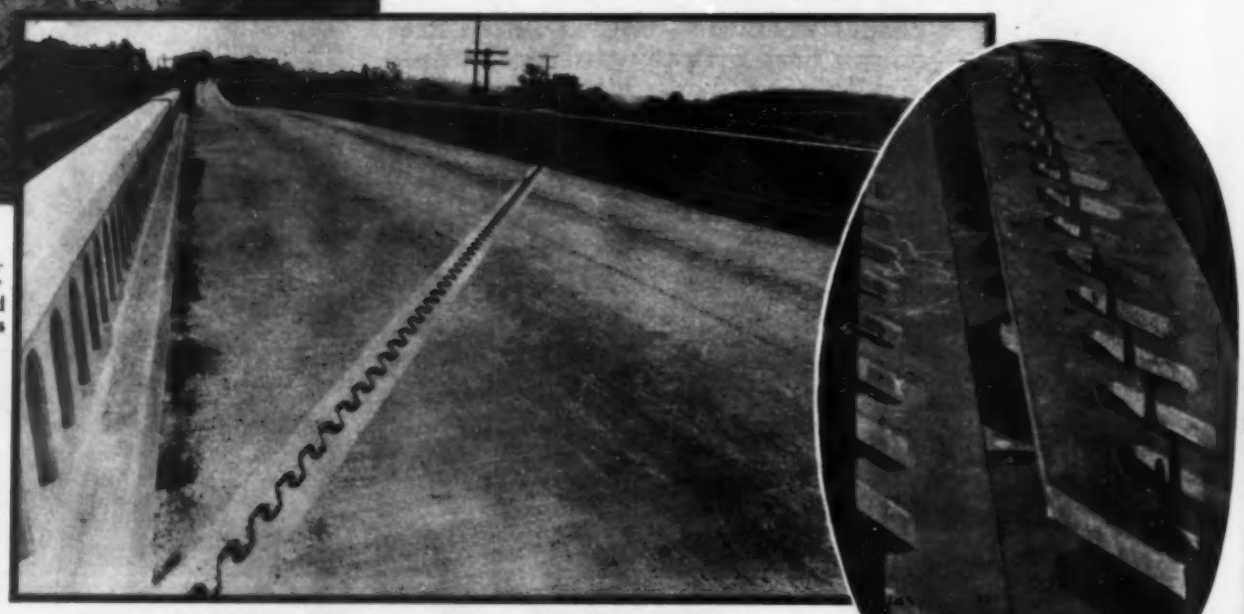
lowers pipe into trench on grade separation project on U. S. 16 near Hill City S. D. After pipe has been leveled and connected, LeTourneau bulldozer backfills trench with earth.

WANTED —

Photos of Details

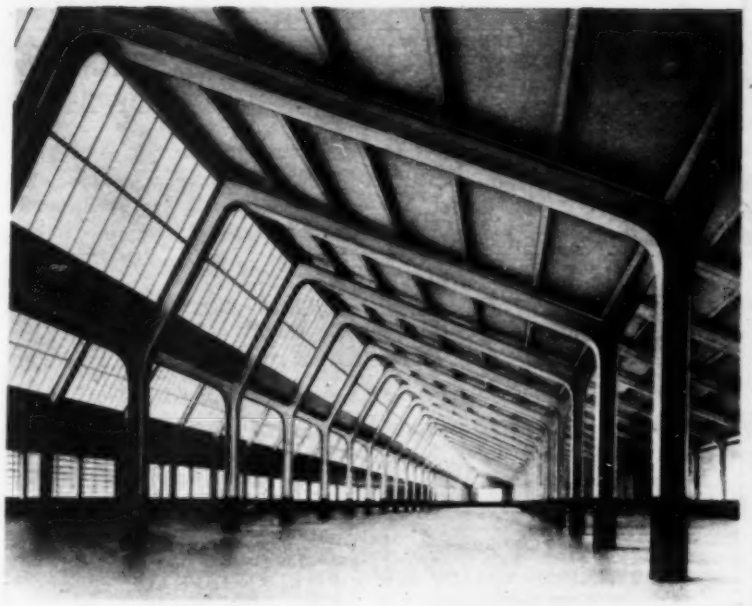
The Editor of Construction Methods wants photographs or sketches illustrating interesting DETAILS of method or equipment and will pay for those he finds acceptable for publication.

Hasn't your job produced some DETAIL that might be illustrated on this page? Send along a picture of it; we'll return it promptly if we can't use it.



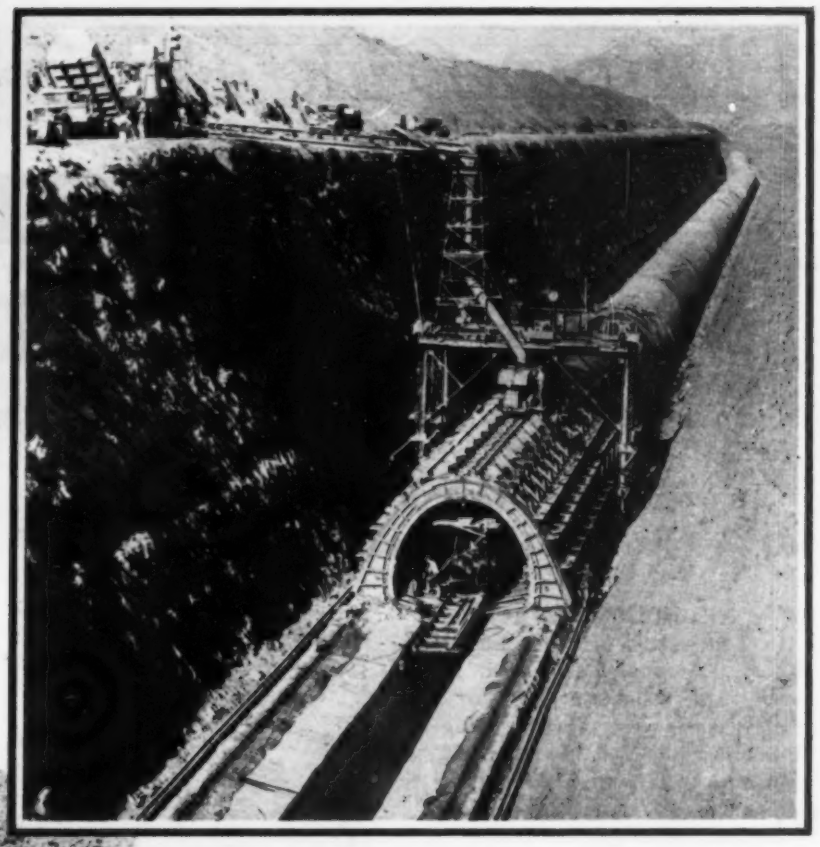
FLAME-CUT EXPANSION GUARD PLATES

(above and right) produced from 1½-in. steel plate by Lukens Steel Co., Coatesville, Pa., are installed on Illinois Central R.R. overhead near Le Roy, Ill., by A. C. Woods & Co., Rockford, Ill., for Illinois Division of Highways. Flame-cut expansion plates are 10 to 15 per cent cheaper than cast-iron finger-type expansion guards and are proportionately cheaper than cast steel.



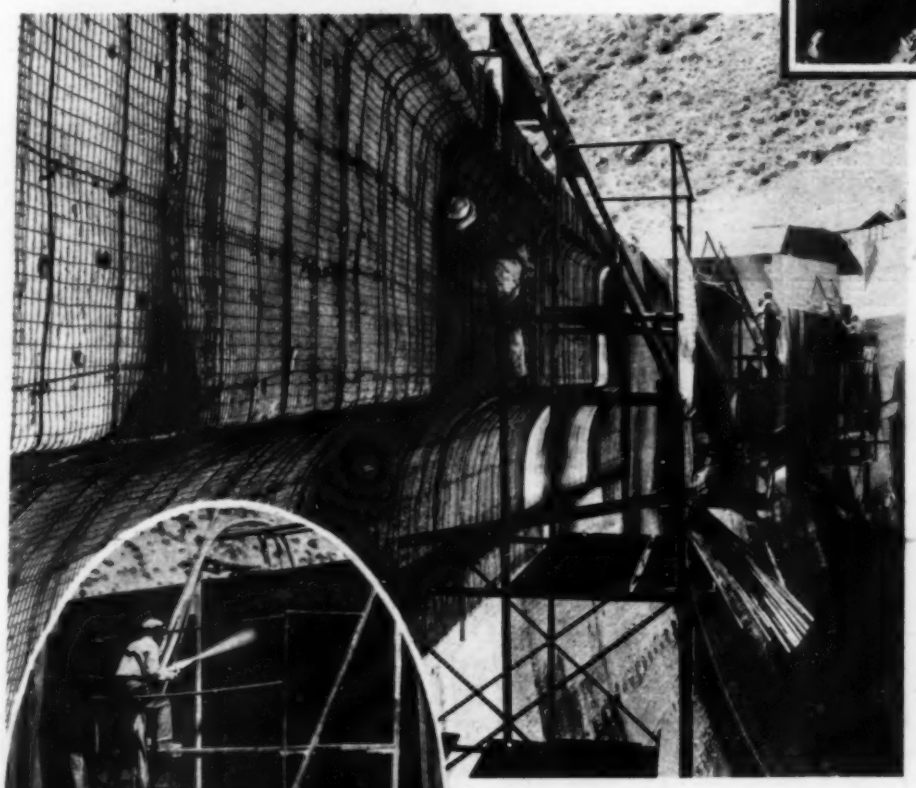
WELDED RIGID-FRAME CONSTRUCTION

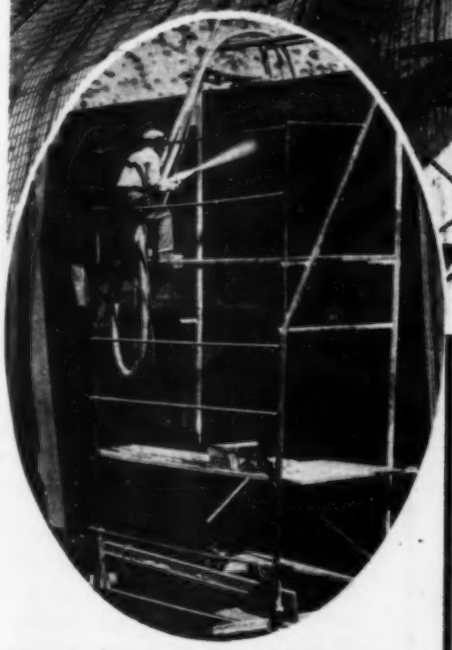
developed by the Austin Co., Cleveland, for single story industrial buildings provides broad factory aisles, clear headroom to full ceiling height and maximum uniform daylight unobstructed by cross members or trusses. Continuous sawtooth frame permits economical construction of aisles up to 50 ft. in width.



HORIZONTAL CONVEYOR

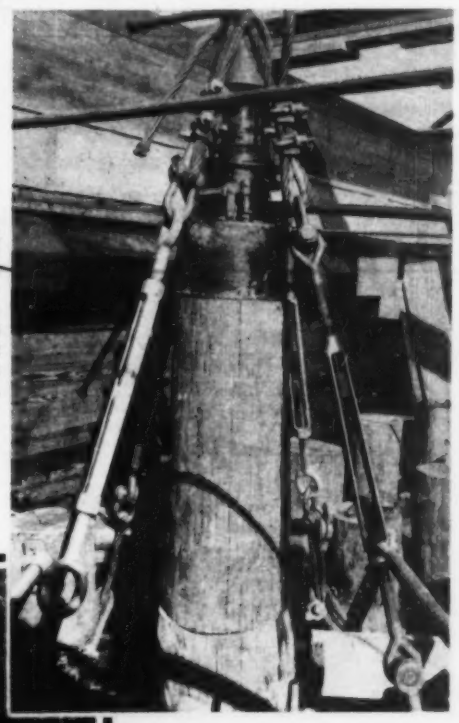
delivers concrete from paving mixer to vertical spout supported in tower of movable gantry which also moves arch forms on cut-and-cover section of Colorado River aqueduct being built by Metropolitan Water District of Southern California. Each unit of concrete delivery system discharges into center of receiving hopper, thus avoiding segregation of concrete.





TO CHECK DETERIORATION

caused by freezing on downstream face of Arrowrock dam *(above)* on Boise reclamation project, Idaho, T. E. Connolly, Inc., of San Francisco, contractor, puts Gunite facing *(in oval)* on upper part of structure and protects remainder with reinforced-concrete slab. Under same contract U. S. Bureau of Reclamation is raising height 5 ft. to maximum of 354 ft., increasing storage capacity from 280,000 to about 294,000 acre-ft.



BEARING TEST

(right) by U. S. Engineers for wood pile in foundation of Mississippi River Dam No. 21 at Quincy, Ill., utilizes 75-ton hydraulic jack tied down to four driven piles.

TRAVELING MACHINE SHOP

(left) equipped with motor-generator set for driving power tools keeps equipment in first-class working condition for Nello L. Teer, Durham, N. C., contractor on Section 2A1 (North Carolina) of Blue Ridge Parkway.

Planning and Plant *for* **HEAVY CONSTRUCTION**

FOURTEENTH OF A SERIES OF ARTICLES

Principles and Practices of Job Layout and Selection and Use of Equipment for Large Dams and Appurtenant Works

By ADOLPH J. ACKERMAN and CHARLES H. LOCHER
Construction Plant Engineer *Construction Consultant*
TENNESSEE-VALLEY AUTHORITY, KNOXVILLE, TENN.

14 . . . Transporting Equipment

ONE GREAT OBSTACLE to a common understanding of transporting equipment for moving large volumes of earth, rock, or gravel lies in the variety of designations that are used in stating carrying capacity or output. The following story is typical of the confusion which sometimes develops.

In getting a new job organized, one shift was trying hard to beat the other in establishing the best daily output to serve as the "goal rate." At the end of the first day, the dragline runner came out and said, "Well, that's a good start in this stiff clay. We put out 2,420 yd.; I counted 1,210 loads on the 2-yd. bucket." The hauling foreman retorted, "That can't be right. The new wagons are rated at 10 yd., and we had 302 loads; that makes 3,020 yd. It only took four bucket loads to fill each wagon, but your buckets were heaping full."

EFFICIENT DESIGN of traveling plant unites tractor, continuous mixer, and 6,000-gal. road oil tank-trailer. Processed material is ready for spreading and rolling.

Table 1 . . . Variables Which Affect Performance of Transporting Equipment

TYPE OF EQUIPMENT	CLASSIFICATION OF VARIABLES—PERFORMANCE CONTROLLED BY			
	Physical Conditions of Job	*Mat'ls to be Handled*	*Limitations in Machine*	*Method of Operation*
Scrapers Trucks Tractors & Wagons	1. Length of haul (Pit & Road) 2. Type of bottom (1) Muddy (2) Hard (3) Smooth (4) Rough (5) Sandy (6) Rocky 3. Type and location of "Out" and "Return" ramps 4. Type of road or route 5. Hauling grade (Ramp & Road) 6. Depth of excavation 7. Size and layout of dumping area 8. Weather 9. Proximity to supply of fuel and parts	1. Type of material (1) Sand (2) Gravel (3) Rock (4) Clay 2. Size of pieces 3. Moisture content 4. Specific gravity 5. Swell of material when loosened by loading 6. Sticky or readily dumped 7. Foreign matter	1. Size of load 2. Speed of movement 3. Maneuverability of machine under various road and weather conditions 4. Reliability and performance of power unit 5. Type of wagon or car body 6. Type of dumping mechanism 7. Quality of machine and maintenance 8. Quality of fuel and reliability of supply	1. Number of units in operation 2. Method of loading 3. Capacity of loading equipment 4. Speed of loading 5. Method of deposition of load (Waste or fill) (Spreading or spot dumping) 6. Layout of cuts, ramps, and roads 7. Skill and experience of operators & supervisors
Trains	10. Stability and drainage of subgrade 11. Curves (Vertical and Horizontal) (See also 1, 5, 7, 9 above)	(See 1, 2, 3, 4, 5, 6, 7 above)	9. Alignment of track 10. No. of cars per train (See also 1, 2, 3, 5, 6, 7, 8 above)	8. Track and switch layout 9. Disposal of dumped material from track (See also 1, 2, 3, 4, 5, 7 above)
Belt Conveyors Tramways	12. Supporting structure required (Trestle or Tower) 13. Layout & location of loading & discharge terminals (See also 1, 6, 7, 8, 9, 11 above)	8. Abrasive qualities (See also 1, 2, 3, 4, 5, 6, 7 above)	11. Size of load or width of belt 12. Type of power and power control (See also 2, 3, 4, 6, 7, 8 above)	10. Layout of Conveying system 11. Layout of feeder system (See also 1, 2, 3, 4, 5, 7 above)
Sluicing Troughs Dredge Pipe Lines	14. Slope of sluiceway 15. Required lift to pipe discharge 16. Presence of vegetation or stumps (See also 1, 2, 4, 6, 7, 8, 9 above)	(See 1, 2, 3, 4, 7, 8 above)	13. Size of pipe 14. Discharge & velocity of sluicing stream 15. Quality of pump speed control 16. Mobility of equipment (See also 7, 8, 12 above)	12. Alignment of sluiceway 13. Per cent solids carried 14. Number & location of booster pumps in pipe line (See also 1, 2, 3, 4, 5, 7 above)

The argument brought on a careful measurement of the wagon body, and it was found to have 7.8 yd. cubical volume. The foreman muttered, "Well, they advertise a 10-yd. wagon, but the only way you can get 10 yd. is by loading well compacted earth and piling it up high on the wagon. This clay makes big lumps and voids, so we probably have only 9 yd. per heaping load, or 2,718.

But even that wasn't right. The engineer's cross-section of the pit showed 2,160 yd. bank or "pay" measure for excavation. The clay was hauled to the site of the earth dam and compacted as well as possible into still another yardage, namely, 2,250 yd. of *fill*. Altogether, the same volume of clay had been given five designations of yardage: 2,420, 3,020, 2,718, 2,160 and 2,250.

At present, excavator buckets and dippers are rated by cubical content, while hauling equipment is largely ad-

vertised on the basis of heaping full measure of uncompacted material. As a further inconsistency, railroad cars are rated at water-level capacity, or straight cubical content.

It would be a great help if all equipment were rated at "cubical" or "water-level" content and if all yardages of materials were referred to in publications as "bank measures," especially when referring to materials in buckets or transporting units.

Job Planning — The first step in planning a job of a given total yardage is to determine the most economical and practical daily and hourly production rate. The general plan of operation with respect to excavating and hauling must be coordinated to keep all equipment moving through the job. A complete plan of excavation, loading, and dumping for the entire job is desirable.

Local conditions and the type of material must be properly related to the general performance of the equipment. There are a great number of variables which adversely affect the output of transporting equipment, as may be seen by referring to Table 1. In making a proper determination as to type of equipment, these variables, together with other local conditions, require first consideration.

Table 3 . . . Loading and Hauling 700,000 Yd. of Earth

(ESTIMATED OUTPUT 70,000 YD. PER MONTH (AVERAGE) FOR 10 MONTHS)

EQUIPMENT PERFORMANCE

2-Yd. Dragline	
Bucket load (bank measure)	1.5 yd.
Cycle time	30 sec.
Output per hour (best)	180 yd.
Output per day of 22 hr. (practical) 180x22x0.75	3,000 yd.
Output per month of 25 days	75,000 yd.
Tractors & Wagons	
Loaded haul	800 ft.
Capacity of 12-yd. wagons (bank measure)	2 yd.
Number of bucket loads per wagon	6
Time of loading and moving out	3.5 min.
Hauling at 2.5 m.p.h.	2.6 min.
Return at 5.0 m.p.h.	1.5 min.
Turning, dumping and waiting	2.1 min.
Total cycle time per unit	10 min.
No. of trips per hour	6
Yards per hour at 9 yd. per load	54
Number of units required to haul 180 yd. hr.	4
(This allows 36 yd. hr. of spare hauling capacity)	

EQUIPMENT

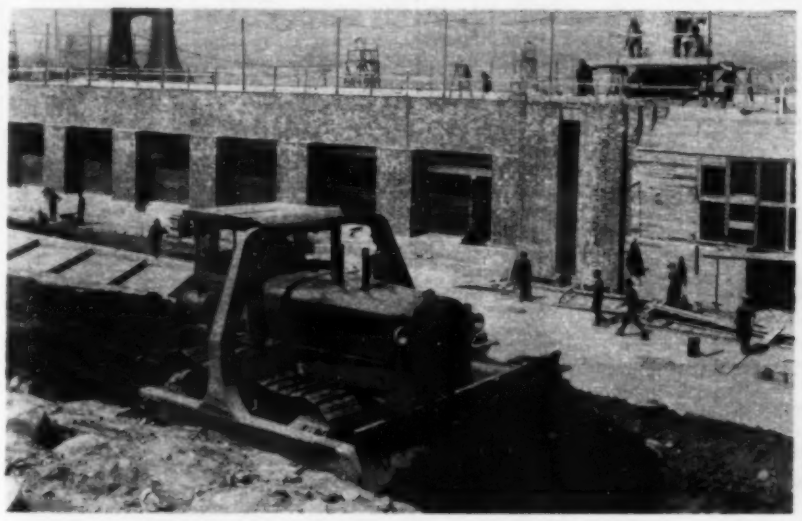
Cost of Loading Equipment		
2 yd. Dragline	$34,000.00	
48-in. Elev. Grader (used)	4,000.00	
Trucks (¼ cost)	2,100.00	
75-hp. Tractor	6,700.00	
		$36,800.00
Cost of Hauling Equipment		
4 75-hp. Tractors	26,800.00	
4 12-yd. wagons	13,140.00	
Misc. Tools	1,945.00	
Trucks (¼ cost)	2,100.00	
		43,985.00
Depreciation per month on basis of 10 months' use		
Loading	3,680.00	
Hauling	4,398.50	
Total Monthly Equipment Cost (Disregarding salvage on equipment)		8,078.50

LABOR AND EXPENSE (3 shifts)

	Rate	Cost per Month	
Loading Labor			
3 Foremen	$1.90	$ 864.00	
3 Dragline Operators	1.00	576.00	
3 Oilers	.75	432.00	
3 Tractor men	.75	432.00	
3 Grader men	.60	345.60	
3 Truck drivers	.60	345.60	
			$ 2,995.20
Expense			
Repairs		1,000.00	
Fuel		151.60	
Oil & Grease		120.00	
Cable		175.00	
			1,446.60
Hauling Labor			
3 Foremen	$1.80	$ 864.00	
12 Tractor men	.75	1,728.00	
3 Wagon Winders	.45	259.20	
3 Greasers	.60	345.60	
3 Greaser helpers	.45	259.20	
3 Mechanics	1.00	576.00	
3 Mechanic helpers	.60	345.60	
2 Electricians	1.00	384.00	
2 Welders	1.00	384.00	
2 Welder helpers	.50	192.00	
3 Waterboys	.45	259.20	
			5,896.80
Expense			
Repairs		1,025.00	
Fuel		549.00	
Oil & Grease		475.00	
Misc. Supplies & Tools		95.00	
			2,144.00
Total Monthly Labor and Expense			$12,182.60

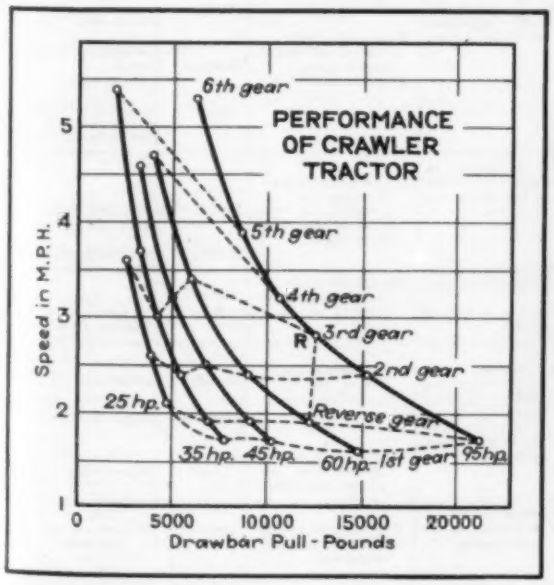
	$ 8,078.50		
	12,182.60		
Monthly Cost	20,261.10	Cost per yard	20,261.10 / 70,000 = 28.94 cents
Monthly Output	70,000 yd.		

This cost is exclusive of superintendence, overhead, interest, bond, etc.



TRACTOR AND BULLDOZER move 2 cu.yd. of earth.

PNEUMATIC-TIRED SCRAPERS are hooked in tandem behind powerful tractors.



TRACTOR draws two crawler tread wagons, each carrying 8 cu.yd. of earth.

SIDE-DUMP WAGON of 10-yd. capacity drawn by tractor hauls material on rock job.

A typical illustration of the difference in operations that might be obtained, depending upon the type of planning, lies in such questions as: Should loading be done with a shovel in the pit and the hauling unit come out on a grade, or should the loading be done by draglines with possibly a different type of hauling unit running on top of the bank?

Hauling Routes and Disposal of Material — There are two classifications of hauling routes, namely, "road haul" and "construction haul." Road hauls are usually for long distances over smooth surfaces with firm footing and, when of considerable distance, are undoubtedly truck hauls. Construction hauls are usually not more than 1,000 or 1,500 ft., over rough runways with only fair or poor footing, and it becomes a matter of more careful analysis to choose between trucks and tractors. The general layout of routes must give careful consideration as to how the selection of routes might influence equipment performance and the number of units required, together with a practical analysis of terminal facilities, traffic control, maneuvering space, and drainage of roads, pit and dump.

A further important element in job planning for transporting equipment lies in proper arrangement for disposal of material. Where it is hauled to a dump, the layout of the dump and organization of dumping operations deserves considerable study, and sufficient dumping points should be maintained to avoid confusion or time loss in waiting to dump. Again, if disposal is to a fill, the fill should be maintained with enough leveling and tamping equipment to prevent waiting by hauling units. Similar requirements are needed for stockpiling by providing sufficient handling equipment and preventing the accumulation of carelessly dumped material. Where a transfer is made from one type of transporting equipment to another as, for example, from conveyors to trucks or wagons, it is generally more practical and economical to build suitable surge bins from which loading is fast and easy and by means of which intermittent production is equalized.

Selection of Equipment — Important factors to be considered in making a selection of equipment are: (1) the cost of owning and operating the loading and hauling equipment; (2) the pay-load that can be delivered by the hauling unit, due consideration being given to grade, traction, maintenance, and the many other variables that affect output; (3) the round-trip time cycle of a hauling unit (which includes loading, hauling, dumping and return time); (4) the number of units per hour that can be loaded by the loading unit, with proper allowance for exchange time of hauling units and time loss by delays that seem unavoidable. Many operators, to overcome time losses by delays, figure a 50-min. hour instead of a 60-min. hour when estimating jobs. The key equipment is usually the loading unit. The larger the hauling unit, the greater is the production of the loading equipment; and the less time is lost in exchanging hauling equipment; but this principle reaches its limit when the higher speed of smaller units on long runs becomes a factor to offset loading delays.

Needless to say, there are many jobs where a proper analysis of equipment would materially decrease the cost per yard. It is quite natural that many times an operator endeavors to make the job fit the equipment, whereas a small additional investment would make the equipment fit the job, and in many cases the saving would entirely

Table 2 . . . Transporting Equipment — General Data

A	1	2	3	4	5	6
TYPE	SPECIAL ADVANTAGES	LIMITATIONS			B SIZE	RATED CAPACITY PER LOAD
		WEATHER	MATERIAL	ROUTE Condition, Type Maximum Grade, Etc.		Water Level Cu.Yd. / Heaping Full Cu.Yd.
TRACTOR DRAWN SCRAPERS	Combined loading and dumping unit. Fast loading and dumping. No delay. Can spread material at dump. Can load, haul and dump with only one operator.	Unsuited in rain or mud.	Best suited to earth. Can handle sand to heavy clay and loosened shale and gravel. Low output in sticky clay. Scarifier may be required for solidly compacted material.	Only general road maintenance req'd. Maximum grade 25% on firm roadbed.	Small Medium Large	6 / 7.5 8 / 9.5 12 / 15
TRUCKS	High mobility. Adaptable to various types of hauling. Single unit for power and hauling. High speed haulage and return. Can back easily.	Poor going in rain or mud.	Able to handle all types depending on body design.	Requires special road maintenance. Maximum grade 15% to 25%.	Small Medium Large	4 / 5 8 / 10 12 / 15
RUBBER TIRED TRACTORS AND WAGONS	Fair mobility. Can handle large loads. Medium speed haulage and return. Side, rear or bottom dumping available. Can operate in tandem for long hauls. Sharp turning radii.	Poor going in rain or mud.	Able to handle all types depending on body design.	Fair road maintenance desirable but not essential. Maximum grade 25%.	Small Medium Large	6 / 7 10 / 12 15 / 24
CRAWLER TRACTORS AND WAGONS	Fair mobility. Can operate on soft and rough ground with large loads. Side, rear or bottom dumping available. Can operate in tandem for long hauls.	Rain and mud reduce production.	Able to handle all types depending on body design. Bottom dump for earth; side or rear dump for heavy rock.	Only general road maintenance req'd. Maximum grade 25%.	Small Medium Large	6 / 7.5 10 / 13 15 / 18
RAILROAD TRAINS	Effective high speed and long range haulage. Economical haulage over a fixed route. Electric systems avoid gases for underground service. Low mechanical maintenance.	No limitations.	Able to handle all types depending on body design.	Requires expensive rail and roadbed construction and maintenance. Maximum grade depends on locomotive used. Average max. 3%	Small Medium Large	Locomotive 8-ton gas. 2 6-yd. cars Locomotive 30-ton Diesel 4 15-yd. cars Locomotive 90-ton Steam or Diesel 7 to 10 30-yd. cars
BELT CONVEYORS	Continuous and uniform haulage at high efficiency. Low labor and repairs requirement. Can be supported on lightweight bridges, trestles or suspension cables to avoid rough ground and long detours.	Unless covered, rain will decrease output seriously when handling earth or clay.	Size of pieces is limited by width of belt and shape of rollers. Wet, sticky material is hard to handle. Requires a special feeder.	Any route for which supports can be provided for the ends of the conveyor flights. Maximum grade up to 40%, depending on material.	Small Medium Large	Belt width, 24 in. 300 cu. yd. per hr. Belt width, 36-in. 850 cu. yd. per hr. Belt width, 60-in. 2,500 cu. yd. per hr.
AERIAL TRAMWAYS	Carries material over rough, rugged terrain and over long distances. Avoids surface congestion of traffic. Low labor requirements. Can often carry load by gravity, requiring only a small amount of power to return the buckets.	High winds hamper operations.	In general, small buckets limit the material to small pieces such as crushed ore, sand, gravel and similar material.	Long spans and angles in the line are not desirable. Maximum grade limited only by power available.	Small Medium Large	Bucket size, ½ yd. Bucket size, 1 yd. Bucket size, 4 yd.
DREDGE LINES	Subaqueous excavation. High production from single digging unit. Especially suitable for moving and placing core material in hydraulic fill dams as the discharge system permits the graded deposition of particle sizes.	Storms, floods and ice hamper the operations on the floating dredges. Can operate and place fill through ordinary rains and changes in water level.	All types which can be broken by the cutter-head. Size of pieces is limited by size of discharge line and the clearance in the pump.	Any route on which the pipe can be supported. Straight line and constant grade layout is desirable.	Small Medium Large	(6-in.) 15 to 45 cu. yd. per hour (16-in.) 140 to 425 cu. yd. per hour (30-in.) 650 to 2,000 cu. yd. per hour

cover the cost of the necessary new equipment. Fig. 1 is an interesting illustration of how equipment may be made to fit the job. A complete traveling plant was assembled for road-mix construction by combining a tractor, mixer, and oil tank into one unit. It would not take much imagination to visualize a spreading and rolling unit attached to this caravan and possibly even a comfortably cushioned and shaded buggy for the inspector!

Economics of Hauling Equipment— A sample method of computing hauling costs is given in Table 3. This kind of analysis should be made for various types of equipment and different combinations which may be finally tabulated into something like Table 4, which is a sample analysis of comparative hauling costs.

18-YD. BUGGY *(right)* mounted on 16 pneumatic tires hauls earth and rock loaded by power shovel.

TO DUMP 18-yd. buggy *(below)*, body slides to rear.

Table 2 . . . Transporting Equipment — General Data

7	8	9	10	11	12	13	14	15	16
RATE OF MOVEMENT M.P.H.	LIFE OF UNIT Economical Hours of Operation	AVERAGE COSTS INITIAL Dollars	OPERATING	MAINTENANCE AND REPAIR	TOTAL For Av. Life of Equipment	ACTUAL JOB EXAMPLES PROJECT	JOB YARDAGE Cu.Yd.	LENGTH OF HAUL Maximum Feet	Minimum Feet
			Dollars Per Hour of Operation						
3	10,000	$8,400	$1.10 to 1.50	$1.15 to 1.45	$3.10 to 3.80	Atlantic-Gulf Ship Canal 3 12-yd. & 1 8-yd.	2,580,000	700	500
3	12,000	10,800	1.30 to 1.70	1.40 to 1.70	3.60 to 4.30	Tri-City Airport, Tenn. 1 8-yd. & 3 12-yd.	1,448,000	1,800	—
3	18,000	12,600	1.40 to 2.00	1.75 to 2.25	4.00 to 5.10	Highway-Crescent City, Calif. 2 12-yd. & 3 7-yd.	670,000	1,000	500
26	10,000	2,800	.90 to 1.30	.65 to .95	1.80 to 2.50	Boulder Dam Excavation 9 to 16-yd. size	1,200,000	3,960	200
11	12,000	8,000	1.30 to 1.70	1.40 to 1.80	3.00 to 3.90	Norris Quarry 6 to 7 units, 12-yd. rated size.	2,180,000	1,450	200
3	12,000	8,000	1.40 to 2.00	1.80 to 2.20	3.90 to 4.90	Fort Peck Excavation Foundation, 250 6-yd. size.	4,100,000	9,000	7,500
						Spillway, 96 8-yd. size.	10,850,000	8,000	5,000
9	10,000	6,500	1.20 to 1.60	.95 to 1.25	2.70 to 3.40	Pickwick Dam 4 to 7 11-yd. tractor-trucks	503,000	1,800	200
8	10,000	8,500	1.30 to 1.70	1.35 to 1.65	3.50 to 4.20	Cordelia-Carquinez Hwy., Calif. 1 24-yd. buggy	1,166,000	1,800	
						San Francisco-Oakland Bay Bridge 4 24-yd. buggies	300,000	2,400	
4	12,000	12,000	1.40 to 2.00	1.75 to 2.15	4.35 to 5.20	Piedmont Dam 2 30-yd. buggies.	615,000	1,900	
3.5	10,000	7,000	1.10 to 1.50	1.30 to 1.80	3.00 to 3.70	Atlantic-Gulf Ship Canal 8 10-yd. & 1 6-yd.	2,110,000	700	500
3.5	10,000	9,000	1.30 to 1.70	1.40 to 1.70	3.50 to 4.20	Grand Coulee Dam Excavation 12 to 30-yd. tractor wagons & trucks feeding conveyors.	14,000,000	500	—
3.5	10,000	11,500	1.40 to 2.00	1.75 to 2.15	4.30 to 5.30	Madden Dam, Panama 10 8-yd., 5 10-yd. & 6 12-yd.	240,000	4,200	500
4 to 5	20,000	8,000				Fort Peck Dam Std. gauge-general supplies.	15,000,000 (tons)	12.2 mi.	—
10 to 20	30,000	25,000				Boulder Dam (raw gravel) 4 trains, 90-ton locomotive with 7 to 10 30-yd. cars.	4,500,000	7 mi.	—
15 to 30	30,000	Depends on size of train				Boulder Dam (aggregate) 50-ton hopper cars. (Hauling to Lomix Batcher)	3,000,000	4.7 mi.	—
4.5	20,000	Depends on length				Pickwick Dam Aggregate, 24-in. belt.	800,000	1,525	—
						Concrete, 30-in. belt.	600,000	247	—
5.7	20,000	Depends on length				Grand Coulee Dam Foundation Excava., 60-in. belt.	14,000,000	6,048	—
						Aggregate, 48-in. belt.	3,500,000	3,900	—
6.8	20,000	Depends on length	The above costs on hauling equipment must be modified to suit local conditions.			Atlantic Gulf Ship Canal 2 36-in. belt & crawler stacker	1,200,000	1,000	220
5.5	20,000	Depends on length				Gilboa Dam, New York	450,000	4,000	—
5.5	40,000	1 mile long, cost about $62,000	In the case of Trains, Conveyors, Tramways, Dredge Lines and the like, costs depend entirely on individual installations and local conditions.			Pardee Dam 205 30-cu. ft. buckets.	500,000	18,700	—
5.5	40,000	Depends on length				Madden Dam, Panama 48 32-cu. ft. buckets.	572,000	5,335	—
9.2 (12 f.p.s.)	*50,000 to 75,000	25,000				Fort Peck Dam 4 28-in. dredges, 5 pumps per dredge.	100,000,000	17,000 (max. head of 240 ft.	—
10.2 (15 f.p.s.)	*50,000 to 75,000	100,000				Miami Conservancy District 15-in. dredge.	7,000,000	—	—
11.5 (17 f.p.s.)	*50,000 to 75,000	1,000,000				Pickwick Dam 1 16-in. dredge, 2 pumps per dredge.	2,600,000	4,000	100

*Depends on materials being handled.

In preparing an analysis such as in Table 4, special allowance should be made for lost time, speed and grade in setting up the time table for determining average output. Likewise great care should be exercised in setting up loose measure in relationship to bank measure to keep these on a consistent basis. Following are some of the conclusions which may be drawn from Table 4 *for one particular set of conditions:*

1. The shovel layout costs more than the elevating grader or scraper system, and is slower.
2. On short hauls the scraper is cheaper than the elevating grader system, even with very large hauling units, which, furthermore, are not very flexible and have limitations as to range of application.
3. On long hauls the scrapers cost more than tractors and wagons on account of the higher equipment cost, since a heavier tractor is needed to load a scraper as compared with pulling a free running load.
4. The smaller tractor units appear to be less economical than the larger but slower units, except for short hauls.
5. Trucks are most economical for long hauls because of their greater speed.

Crawler Tractors — Crawler tractors have been generally adopted for moving units for bulldozers, scrapers, wagons, buggies, etc., especially for rough roads or poor traction; their maximum speed is generally about 6 mi. per hour, and they average more nearly 3 to 3½ mi. per hour and are best suited to short hauls of 200 to 1,500 feet, although in some cases they may be employed on considerably greater distances. Their special advantage lies in their ability to travel over very rough surfaces and to climb steep grades up to 25 to 29 per cent at 1.7 mi. per hour, which means that they can rise at the rate of 30 to 40 feet per minute. Where vertical lift is a big item, they get up faster, which is something that cannot be done as readily with trucks running on flatter grades.

The modern trend is toward oil-

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Table 4 . . . Sample Analysis of Earth-Moving Costs
for Various Types of Loading and Hauling Equipment

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
CASE	LOADING EQUIPMENT	HAULING EQUIPMENT				OUTPUT of PLANT Per Hour Cu.Yd.	1,000-FT. HAUL			3,000-FT. HAUL			5,000-FT. HAUL		
		TYPE	Speed Max. m.p.h.	Pay Load Per Unit Cu.Yd.	Cost Hour Unit Dollar		Cu. Yd. Per Hour Per Unit	No. of Units	Cost Per Cu.Yd. Dollars	Cu.Yd. Per Hour Per Unit	No. of Units	Cost Per Cu.Yd. Dollars	Cu.Yd. Per Hour Per Unit	No. of Units	Cost Per Cu.Yd. Dollars
A	2-Yd. Shovel or Dragline	75-hp. Tractor and Wagon	5.3	15.0	4.25	200	66	3	.105	34	6	.164	23	9	.224
B		75-hp. Tractor and Wagon	5.3	8.5	3.75	200	53	4	.108	26	8	.182	17	12	.260
C	Cost, $8.00 Per Hour	Truck	13.5	5.5	3.50	200	48	4	.115	30	7	.154	22	9	.200
D	48-In. Elevating	75-hp. Tractor and Wagon	5.3	15.0	4.25	350	78	4	.075	37	9	.134	25	14	.189
E	Grader	75-hp. Tractor and Wagon	5.3	8.5	3.75	350	60	6	.090	27	13	.158	18	19	.223
F	Cost $6.50 Per Hour	Truck	13.5	5.5	3.50	350	54	7	.095	32	11	.128	23	15	.171
G	Scraper	Tractor	5.3	7.5	3.80	200	56	4	.068	25	8	.152	16	13	.238

burning or diesel engines. Such units, as compared with gasoline engines, use approximately one-half as much fuel and the fuel cost per gallon is approximately 50 per cent less than gasoline. In other words, the use of oil-burning engines saves approximately 75 per cent of what would be expended by the use of gasoline. Economies are also found in less loss from evaporation and pilferage. When the job is in remote sections, a decided saving in the cost of transportation and reduction in fire hazard is also obtained. The following table gives a comparison of fuel costs per hour of 75-hp. tractors:

	Gasoline Tractor	*Diesel Tractor*
First cost	$4,750.00	$6,500.00
Fuel, gal. per hr.	8	5
Cost of fuel, c. per gal.	.11	.07
Cost of fuel per hr.	.88	.35
Saving per hr.		.53

Assuming the life of tractors at 10,000 hr., which is a reasonable estimate, the reduction in fuel cost with a diesel tractor during that period would be $5,300, or almost the first cost of the tractor.

Diesel power is now being extended in its use to shovels, compressors, locomotives, pumping plants, and light plants on construction jobs It is meeting with such universal favor that within a few years it will very largely, if not entirely, replace gasoline power on such work.

Bulldozers — In Chapter 12 *(Construction Methods, Nov., 1936, pp. 40-43)* a general description of bulldozers as earth-moving devices was given, together with a table of output. The average cost of hauling dirt in wagons from a shovel on a 250-ft. haul is approximately twice the cost of moving this material the same distance with a tractor and bulldozer. This unit is particularly good on short distances up to about 200 ft., and it generally pays to investigate bulldozers for prime earth movers on short haul cut-and-fill jobs. Bulldozers, of course, are indispensable in keeping an excavation dump or disposal area shaped up in order to permit other types of hauling units to maneuver at their maximum speed.

+ + +

NEXT MONTH — Chapter 15 of the series on "Heavy Construction" by A. J. Ackerman and Charles H. Locher, to appear in the March issue, will continue the analysis of "Transporting Equipment" with particular reference to tractors and the various types of scrapers, wagons, trucks and compactors.

+ + +

Improved Material for Filling Joints Combines

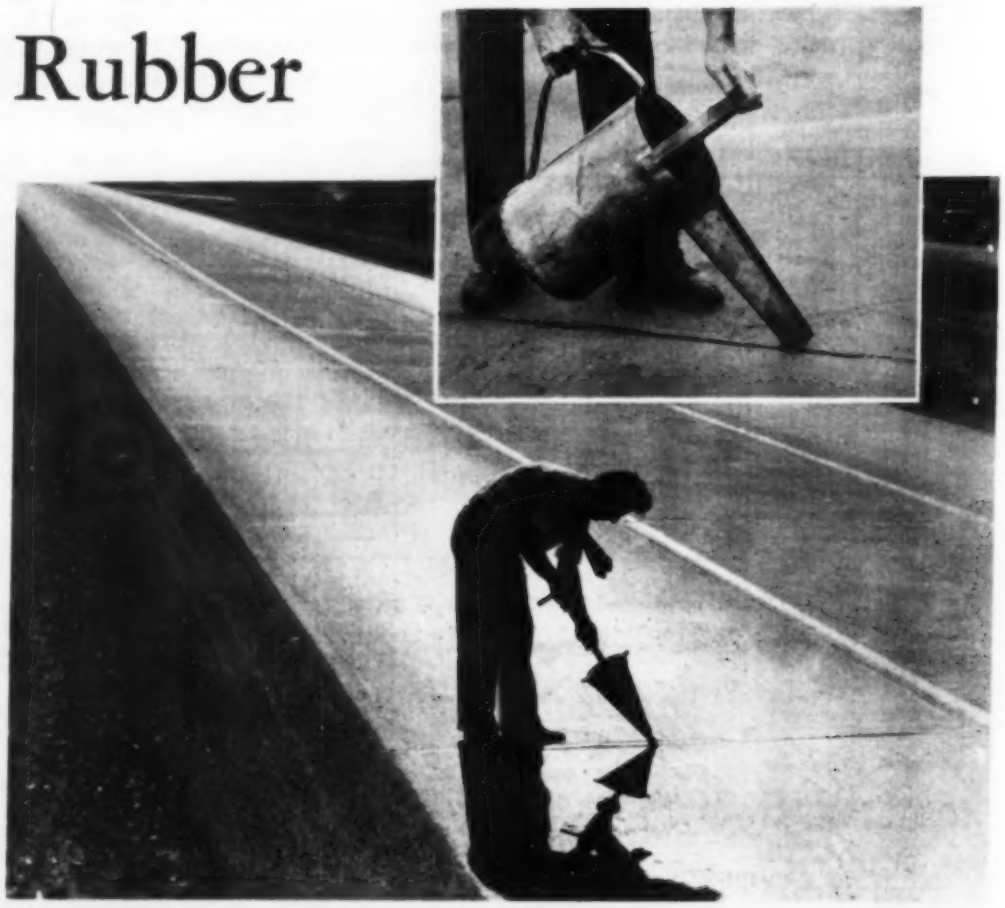
Asphalt and Rubber

AN IMPROVED JOINT FILLER combining bitumen and commercial rubber latex was developed and tested in old and new concrete pavement during 1936 by the laboratory of the California Division of Highways under the direction of Thomas E. Stanton, Jr., materials and research engineer. Cheaper than products using unadulterated specially processed rubber, the new filler possesses the essential characteristic of stickiness combined with little or no tendency to flow at high temperatures and high ductility at low temperatures.

During the first months of trial, best results were obtained with a mixture of about 70 per cent soft-grade slow-curing road oil and about 30 per cent rubber latex of commercial grade. Mixing temperatures had to be maintained at 200 deg. F. or less to avoid foaming of the rubber latex, which is an emulsion of water and rubber. Source of the road oil proved important. Two oils of exactly the same grade from different sources gave quite different results.

A perfect bond and seal attained at the time of installation was maintained through the first 5 months of test and was expected to last through the winter and succeeding years. At $180 per ton for rubber latex and $10 per ton for asphalt, the joint filler cost $61 per ton, or 24.4c. per gallon. For crack filling, gasoline or other suitable solvent was used as a cutback with the road oil to produce the desired consistency, depending upon the width of the cracks.

All work in developing the filler was done by Harry S. Bennett, asphalt testing engineer, and Robert Gillis, chemical testing engineer, Materials and Research Department, California Division of Highways.



TO FILL JOINTS BY HAND, bitumen-rubber filler must be mixed on job and placed while still warm. Filler cannot be softened by reheating after being allowed to harden. SPECIAL POURING POT *(in inset)* prevents filler from blowing out into long threads in wind.

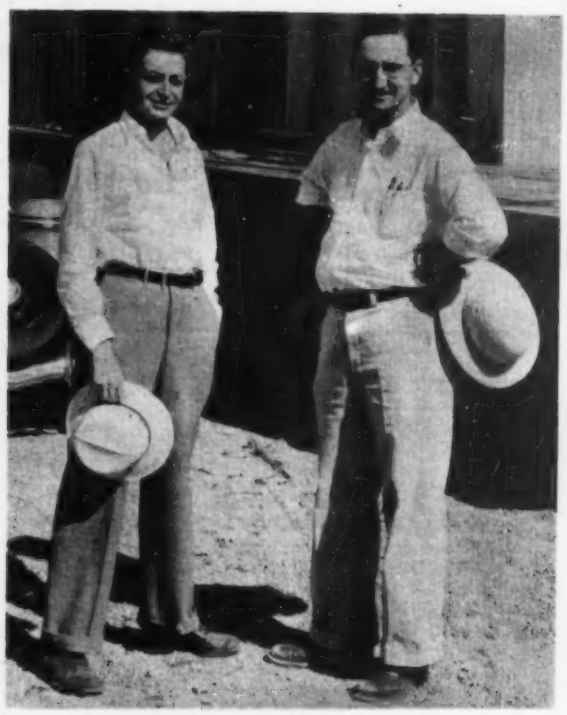
Present and Accounted For ~ A PAGE OF Personalities

TAKING OFFICE JAN. 20

at annual meeting of American Society of Civil Engineers in New York City, LOUIS C. HILL, of Los Angeles, becomes president of organization for current year. During his 50 years' professional practice, Mr. Hill has gained international reputation in fields of dam design and irrigation development. He has had a part in many large reclamation projects in West, in Canada and in Mexico and has served as consulting engineer to U. S. Interior Department and War Department on large dams.

STEEL ERECTOR

for Austin Co. at South Chicago wire mill of Republic Steel Corp. is BUD RUMMEL *(below)*, foreman, who directs erection of structural frame for new plant.



BARTLETT DAM

will be built by Barrett & Hilp and Macco Corp. with EDGAR WHITE (left), engineer, and H. W. McKINLEY, superintendent, in charge at site. Dam, located on Verde River 54 mi. by road northeast of Phoenix, Ariz., is being built by U. S. Bureau of Reclamation as part of Salt River irrigation project to add 200,000 acre-ft. of storage. When completed, dam will be highest multiple arch dam in world, with height of 270 ft.

AQUEDUCT BUILDER

J. F. ("Johnny") HIGH *(left)*, foreman for Thompson-Starrett Co., contractor, on construction of Shaver's siphon, reinforced concrete conduit being built in California as part of Metropolitan Water District's Colorado River aqueduct. Thompson-Starrett Co. holds contracts for 16½ mi. of conduit and siphons on this project.

CHOSEN

to serve second term, W. A. KLINGER *(below)*, president of Associated General Contractors of America, will continue in office during 1937, following official designation at association's annual meeting in San Antonio, Tex., Feb. 15-17. Mr. Klinger is president of William A. Klinger, Inc., of Sioux City, Ia., specializing in building and bridge construction.

DAM BUILDER

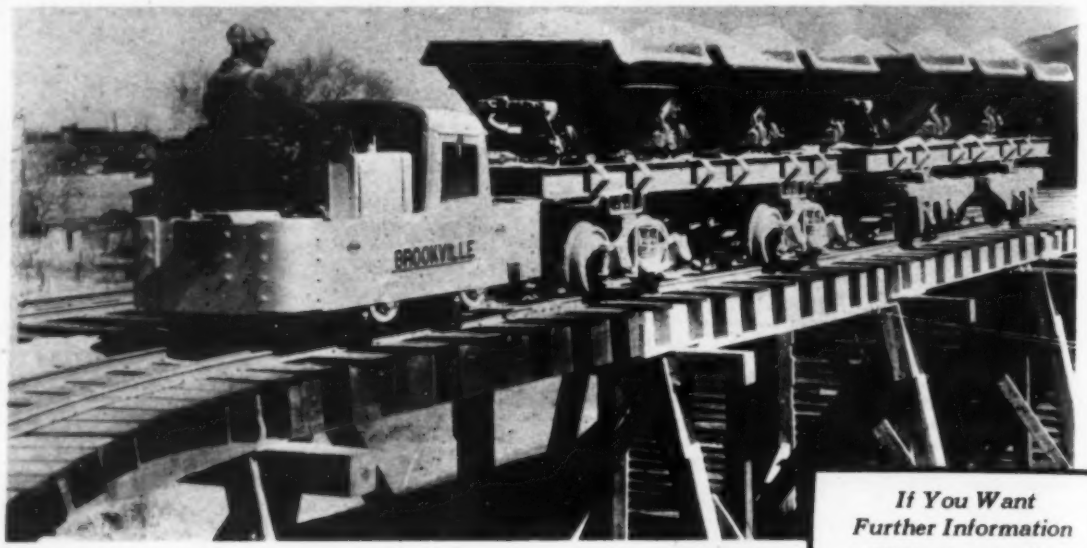
FRANK T. CROWE *(left)*, superintendent of construction on Parker dam for J. F. Shea Co., which has subcontracted work from Six Companies Inc., stands opposite upstream end of two 29-ft. diversion tunnels on Arizona side of Colorado River Oct. 21, 1936, when diversion begins. Tunnels will pass river flow for 2 years during dam construction, directed by U. S. Bureau of Reclamation for Metropolitan Water District of Southern California at intake end of District's 240-mi. aqueduct. After period of diversion, tunnels will be sealed.

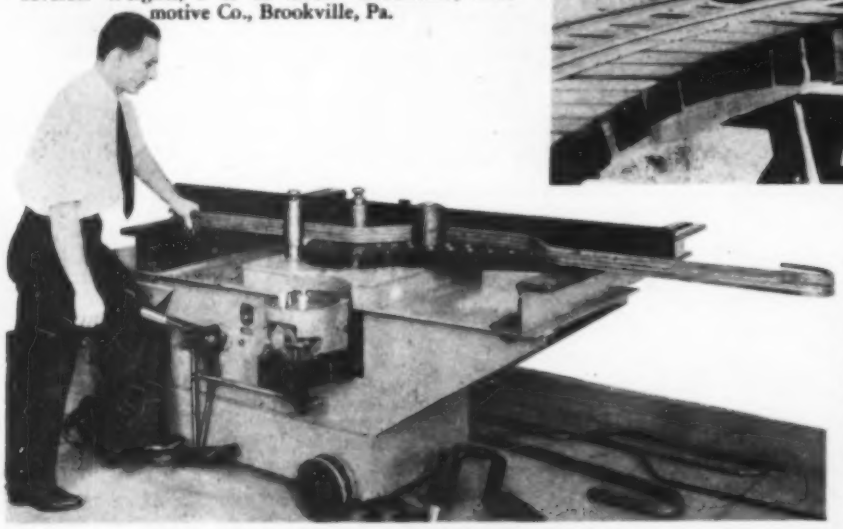
Construction Equipment News

Review of Construction Machinery and Materials for February, 1937

INDUSTRIAL LOCOMOTIVES

gasoline and diesel-powered, for handling material efficiently over fixed routes, trestles and soft foundations. Features: (1) improved dual spring journal suspension for rough track; (2) indestructible steel frame; (3) rounded steel endsills; (4) four-wheel drive; (5) 25 per cent greater traction. Gasoline models, Ford V-8 powered, made in sizes 2½ to 7 tons. Gasoline locomotive pictured above hauls 15- to 20-ton loads over grades as steep as 5 per cent. Diesel models with Caterpillar engines have dry-disk clutches, helical-gear transmissions and five speeds forward and reverse. Weights, 5 to 12 tons. — Brookville, Locomotive Co., Brookville, Pa.



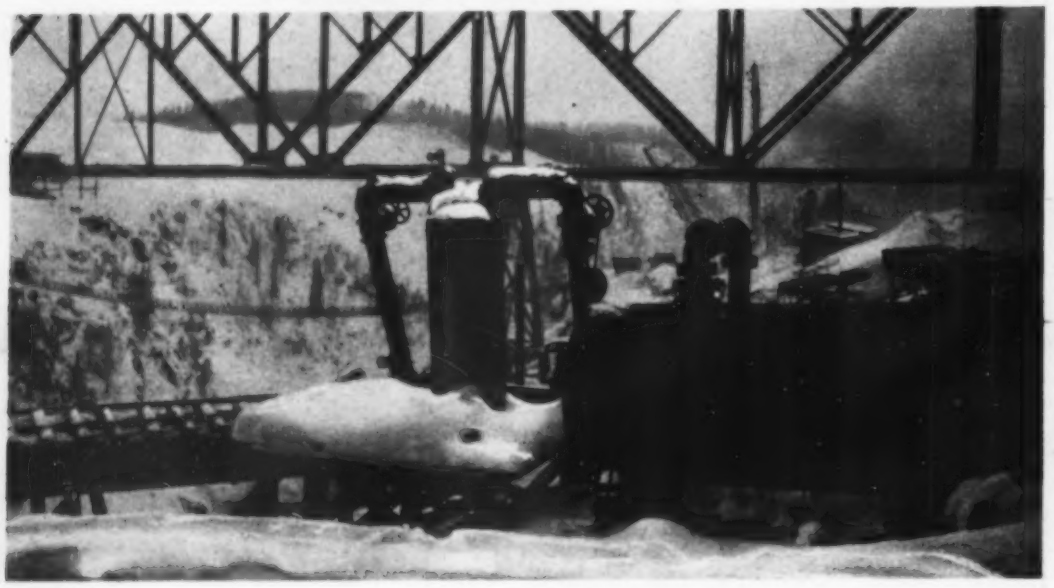


AUTOMATIC BENDING MACHINE

motor-driven, for bending reinforcing bars, bends one or more bars at a time and makes two bendings simultaneously. Equipped with dial plate which controls bending and causes machine to stop automatically when bending is completed. Accomplishments: (1) Bends both hooks and angles on one or more bars at a time; (2) bends two angles in one operation; (3) makes alternate right and left bending by reversing machine; (4) bars move across machine in one direction — do not need to be reversed. Made in four sizes, bending round bars, 1¼ to 2⅜ in. and square bars 1 to 2 in. Net weights from 1,885 to 3,500 lb. Powered by 2- to 5-hp. motors. — G. D. S. Shearing and Punching Machine Co., 101 Walker St., New York City.

CHAIN CLAMP ATTACHMENT

for electric concrete vibrator provides for vibration of concrete sewer pipe forms and of building columns while concrete is being poured. Equipped with hooks which catch any link in chain when placed around form. Screw device actuated by ratchet handle tightens chain clamp securely, transmitting vibration directly to form and thence to mass being placed. Vibrator is simple pulsating electromagnet operating at speed of 3,600 vibrations per minute. Folder describing this equipment and seven-page treatise on vibration of concrete available on request. — Syntron Co., 400 N. Lexington Ave., Pittsburgh, Pa.



AIR-LINE ANTI-FREEZE SYSTEM

(left) for eliminating freezing of air lines and for keeping drills, hoists, brakes and tools operating in temperatures to 70 deg. below zero has been improved to insure economy and greater efficiency in use of Tannergas. Changes in spring loaded valve have reduced quantity of dry gas taken into air line, and improvements in liquid Tannergas have increased its lubricating qualities. Cost of treating 100 cu.ft. of free air per minute is approximately 7c per 8-hr. day. By means of by-passed air, liquid Tannergas in tank is agitated, throwing off dry gas which enters line and treats moisture in compressed air. Non-explosive and odorless. "Thawing out" time saved is said to compensate for installation cost. — Sullivan Machinery Co., Michigan City, Ind.

If You Want Further Information

- Within the space limits of this page it is impossible to present complete information about the products illustrated.
- If you want further details, write for them.

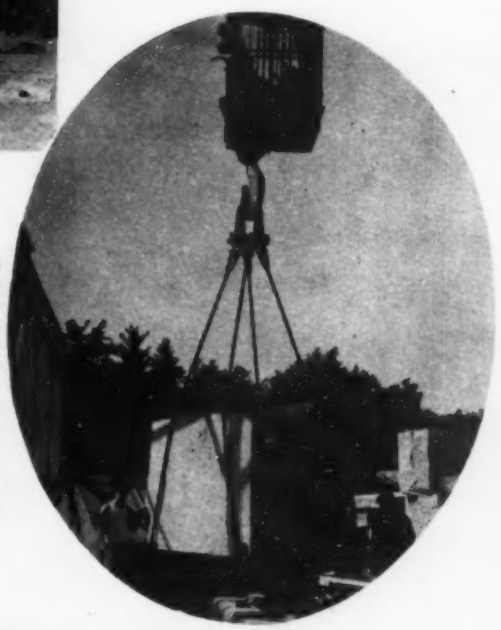
The Editor
CONSTRUCTION Methods and Equipment
330 West 42nd Street
New York, N. Y.

SUPER-TANDEM STRAIGHT-LINE CRUSHING PLANT

(left) consists of roller-bearing primary crusher, roller-bearing roll secondary crusher and Symons vibrator screen. Mounted on solid or pneumatic tires; equipped with gas or diesel power; with straight or swivel-type feed conveyor. Sizes available and detailed specifications given in circular mailed upon request. — Iowa Manufacturing Co., Cedar Rapids, Iowa.

25-TON GRANITE BLOCKS

(right) hoisted into gang saws by two Atlas slings connected to crane hook by shackles. Each sling is 30 ft. long and has open sockets attached to each end. Braided body is made of two wire ropes spirally interwoven to form eight-part wire rope body which makes kink-resisting sling more than twice as flexible as piece of wire rope of same strength. Slings hug load and prevent slipping. Loop in braided body of sling may be drawn down tight and pulled out straight without kinking; single-part wire rope would kink under these circumstances. Slings shown had been in use 4 months and still were in excellent condition when picture was taken. — MacWhyte Co., Kenosha, Wis.



VITRIFIED CLAY LINER PLATES

(left) for protecting surfaces of concrete and reinforced-concrete sewers. Made of clay, dried, burned and salt-glazed with smooth surface and hard, dense body. Advantages: (1) Prevent disintegration due to action of acids or other chemical wastes; (2) protect against action of destructive gases; (3) withstand scouring effect of sand, gravel and other detritus; (4) help prevent cement from being leached out of concrete; (5) occupy minimum area of sewer cross-section; (6) reduce frictional resistance to flow of sewage. Standard length, curved and flat, 18 in. Width, flat, 9 in.; curved plates vary according to circumference. Weight of standard 9x18-in. plate, either flat or curved, 15 lb. Catalog describes and illustrates methods of placing plates. — Robinson Clay Product Co., Akron, Ohio.

2-TON TANDEM ROLLER

for light work on highways, athletic fields, airports, race tracks, tennis courts and golf courses. Small and compact for ease of handling in narrow and restricted places inaccessible to large rollers. Will operate between street car tracks and close up to curbings. All complicated transmissions and mechanisms eliminated. Operates like automobile with automotive steering mechanism, foot brake pedal and foot throttle control of engine. One speed forward and two reverse. — C. H. & E. Manufacturing Co., 3849 Palmer St., Milwaukee, Wis.

REPAIR TRUCK

in operation on power lines of Public Service Co. of Indiana. Special body has horizontal doors on side which open into individual compartments where miscellaneous small supplies are carried. Large center part of body, which has rear door, carries wire, insulators and other equipment used in large quantities. On top of truck is special extension ladder which may be elevated quickly for emergency repair work. With addition of new unit, company now operates 70 Dodge trucks of various types and sizes. — Dodge (Division of Chrysler Corp.), Detroit.

BURIED PIPES AND CABLES

(left) are located without electrical contact by means of new instrument called M-Scope which measures their depth and permits rapid and accurate mapping of underground metallic systems. Consists of two specially designed radio units, transmitter and receiver, which are operated by one or two men according to service. Operator switches on transmitter, adjusts earphones and carries both units in direction of line. By sounds in phones and position of needle on indicator meter, location and depth of main and branch pipe lines, including valves, junctions, etc., can be calculated. Nearly all parts are standard radio equipment and can be repaired by competent radio man. Energy supplied by dry cells. Weight, individual units, 8 lb. each; complete with carrying case, about 22 lb. — Fisher Research Laboratories Sales Co., 45 Rockefeller Plaza, New York City.

Construction Equipment News

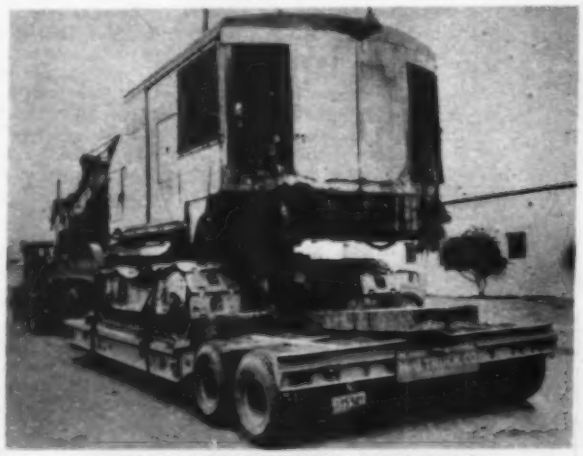
(Continued)

SAFETY HAT

for protection of workmen engaged in hazardous occupations. Moulded of duralumin metal (specially hardened heat-treated aluminum alloy). Advantages: (1) duralumin crown, light in weight, durable, waterproof and non-corrosive; (2) absorbs force of blow by denting, thus cushioning shock; (3) polished metal surface reflects heat making hat 15 deg. cooler; (4) safety cradle for head *(in inset)* has 6-point suspension permitting greater blow distribution; (5) floating head band is interchangeable and fits any head size or shape; (6) moulded rubber brim, slightly flexible, saves hat from being knocked off in close places. Chin strap may be attached. — Davis Emergency Equipment Co., 55 Van Dam St., New York City.

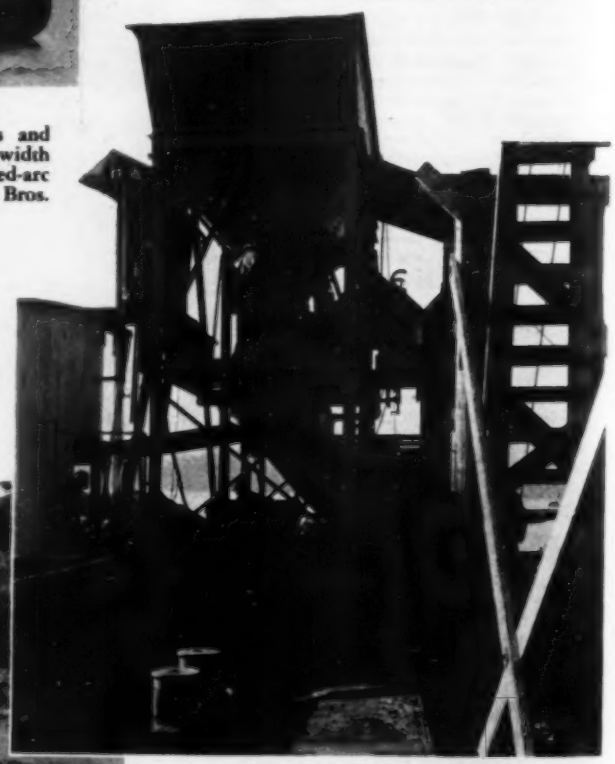
3-HP. GASOLINE ENGINE

(left) countershaft-driven unit designed to be operated at high speeds for compacting concrete and at low speeds for concrete surfacing or rubbing. Delivers speeds ranging from 1,500 to 2,500 r.p.m. which produce vibration frequencies of 3,000 to 5,000 per minute. For surfacing concrete and for removal of board and fin marks low speeds are most satisfactory. By using fractional speed angle spindles, it is possible to run grinding wheels as low as 150 r.p.m. to eliminate throwing grout from concrete surface. Attachments available for wet rubbing and dry grinding of concrete. — Mall Tool Co., 7740 S. Chicago Ave., Chicago, Ill.



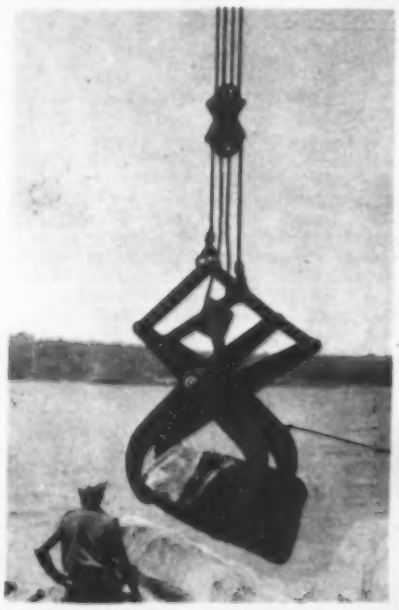
PNEUMATIC-TIRED TRAILER

of 30-ton capacity for transporting steam shovels and other heavy equipment. Overall length, 47 ft. 9 in.; width at deck, 11 ft. 6 in. Entirely arc-welded by shielded-arc process with Lincoln Electric equipment. — Rogers Bros. Corp., Albion, Pa.



NON-TILT MIXER

(Model 28-S) has variable speed drive which makes machine equally efficient on either wet or dry batches. Drum extra large in diameter and narrow for faster charging and discharging. Equipped with renewable full-width liners and converging buckets, wearing edges of which are coated with hard alloy metal to increase life. Other features: reinforced, streamline frame; end-to-center mixing action; batch balanced at center of drum; inclosed gear reduction unit; power discharge direct connected to countershaft in worm and gear running in oil; multiple V-belt drive; self-contained vertical siphon-type water tank; three-way balanced piston-type valve; oversize anti-friction bearings. — T. L. Smith Co., Milwaukee, Wis.



FOUR-TINE GRAPPLE

utilizes two parallel pairs of tines which function independently, gripping object firmly on two sides regardless of irregularities or variations in width. Accomplished by incorporating patented sheave block which equalizes gripping power and eliminates any possibility of stone or other object rolling between tines and dropping out. Recommended on all classes of rock work. Available in three standard sizes and in special sizes on order. — Owen Bucket Co., Breakwater Ave., Cleveland, Ohio.

REAR CONTROL MOTOR GRADER

(below) with 12-ft. moldboard, spring stabilized front end, eight-wheel tandem drive and two-speed variable power control. Streamlined; rigid welded frame; auto-type side entrance cab; heavy-duty scarifier. Power control mounted on four-speed tractor with electric starter, lights and horn and 54-gal. fuel tank. Two sizes, standard and heavy. — W. A. Riddell Corp., Bucyrus, Ohio.

News from Manufacturers
ABOUT THEIR PRODUCTS

The publications reviewed below will keep you posted on latest developments in construction equipment and materials available for your use. If you want copies, ask for them.

ASBESTOS INDUSTRIAL PRODUCTS — **Johns-Manville**, 22 E. 40th St., New York City. (60 pp., illustrated). Insulating materials in sheet and block form for wide range of industrial needs, including pipe coverings. Insulating cements and fillers. Rock cork sheets for refrigerating plants. Flooring materials. Built-up and insulated roofing, with illustrations of construction details and tabulated specifications for wood, gypsum, poured concrete and steel decks. Steeltex floor lath combines wire reinforcement with water-resistant backing serving as forms for concreting. Detailed drawings for industrial roofing and siding of corrugated Transite sheets of asbestos fiber and cement. Also Transite pipe for electrical conduits and pressure water mains.

• • •

PUZZOLANA PRODUCTS—**Master Builders Co.**, 7016 Euclid Ave., Cleveland, Ohio. (16 pp., illustrated). Omicron, synthetic puzzolana which reduces water-cement ratio while increasing plasticity, diminishes shrinkage in concrete and mortar and adds to permanence of cement paints, colored finishes for concrete floors, floor surface hardeners (liquid and dry), seals for damp floors, masonry waterproofing, and integral hardeners for concrete floors.

• • •

FLEXIBLE SHAFT MACHINES—**Mall Tool Co.**, 7740 S. Chicago Ave., Chicago, Ill. (Portfolio of several illustrated bulletins). Gasoline and electric-motor driven tools for vibrating concrete, rubbing, grinding, sanding, polishing, sawing, floor grinding, scratch wire-brushing, die-sinking, filing and metal finishing.

• • •

EARTH MOVERS — **Euclid Road Machinery Co.**, Cleveland, Ohio. (Portfolio of nine illustrated folders). Trac-Truks, big pneumatic-tired 7-9 cu.yd. wagons of semi-trailer type, with 6-cylinder engines in pulling units, for earth movement; details of flexible hitch and wheel wind for closing dumping doors. Complete specifications. Rear-dump trucks in two sizes, 7- and 10-ton. Tu-Way crawler-mounted, 11- and 15-cu.yd. wagons for heavy rock and earth haulage; equipped with double-acting hydraulic hoist for dumping either side. Bottom-dump wagons, crawler- or wheel-mounted; capacities 8-8, 11 and 12 cu.yd. Bulldozers, with double-acting hydraulic jack providing vertical movement for high-lift and down pressure. Two-wheel scrapers with 1- and 1½-cu.yd. pans. Rotary scrapers of fresno type, six sizes, 18- to 56-cu.ft. capacity. Tamping rollers with projecting feet for compacting earth fill.

• • •

DIESEL FUEL TRACTOR—**Allis-Chalmers Mfg. Co.**, Tractor Division, Milwaukee, Wis. (32 pp., illustrated). K-O model, developing 49.58 hp. at drawbar. Controlled electric ignition, engine and tractor parts described.

• • •

WATER IMPEDENCE — **American Colloid Co.**, 363 West Superior St., Chicago. (8 pp. text). Volclay bentonite, a natural, inert, clay-like substance, is used in dry or plastic form to stop passage of water. Applicable to trenches, cofferdams, foundations, cores of earth dams, dikes, tunnels and pressure grouting. Increase in volume at full saturation ranges up to 15 times dry bulk. Test results reported. Separate sheets describing detailed methods are available upon request to manufacturer.

• • •

LIME — **United States Gypsum Co.**, 30 Rockefeller Plaza, New York City. (47 pp., illustrated). General description and properties. Lime in building construction, with tables on bonding power of mortars of various compositions factors of safety, mortar mixes for various types of masonry, and brick and mortar requirements for different wall thicknesses. Practical advice for building contractors on slaking lime. Notes on colored mortar joints, lime for plaster base and finishing, mixing and applying. Watertight concrete with hydrated lime admixture.

MATERIALS HANDLING—**Gifford-Wood Co.**, Hudson, N. Y. (112 pp., illustrated). Pivoted-bucket chain carriers, gravity-discharge bucket elevator conveyors, belt conveyors, continuous bucket elevators, centrifugal discharge elevators, flight conveyors, screw conveyors, drag chain conveyors, apron conveyors, reciprocating feeders, bunkers, gates, trolley buckets, self-tripping buckets, silo storage plants, skip hoists, drag scrapers, slat conveyors, roller conveyors, V-type side-dump cars, revolving screens, vibrating screens, chains and special equipment. Photographs, diagrams, dimensions, specifications and power requirements.

• • •

MATERIALS-HANDLING PUMPS—**American Manganese Steel Co.**, Chicago Heights, Ill. (20 pp., illustrated). Centrifugal pumps from 2 in. to 20 in. designed to handle sand, gravel, boulders, ashes, ore sludge, cement slurry, mine tailings and other solids in suspension. Five types of pumps for various classes of dredging and materials handling service.

• • •

CONTRACTORS' PUMPS—**Jaeger Machine Co.**, Columbus, Ohio. (36 pp., illustrated). Self-priming centrifugals ranging from 2-in. 115-lb. unit pumping 7,000 g.p.h. to 10-in. 3,000-lb. pump of 200,000-g.p.h. capacity. Gasoline, diesel or electric power. Well-points and well-point pumps, jetting pumps, triplex high-pressure pumps, diaphragm and duplex diaphragm pumps. Data on pump capacities, friction losses in pipes, power requirements and pressure conversion tables.

• • •

CONSTRUCTION MACHINES—**Worthington Pump & Mchy. Corp.**, Harrison, N. J. (24 pp., illustrated). Pneumatic-feed and screw-feed drifter drills; wagon drills of tower and Rock Master types (latter adjustable for drilling at any angle); pneumatic hand-held tools for drilling, breaking concrete, driving sheeting, tamping and digging clay; portable compressors in five sizes, 60 to 315 c.f.m. capacity; stationary compressors; small compressors for occasional service; diesel and gasoline power plants; vertical turbine pumps; portable centrifugal pumps; automatic heat-treating and forging machines; multi-V-belt drives.

• • •

STORE FRONTS—**Kawneer Co.**, Niles, Mich., and Berkeley, Calif. (56 pp., illustrated). Resilient, rustless store front construction in modern style for shops, restaurants and bars, illustrated by scores of examples from all over world.

• • •

SHEEPSFOOT ROLLERS — **Blaw-Knox Co.**, Farmers' Bank Building, Pittsburgh, Pa. (8 pp., illustrated). For compacting earth fills. Tamping "feet" of Ateco unit, projecting from roller drum, penetrate 6 to 9-in. earth layers with kneading or rodding action, bonding successive layers. Tabular specifications for one-drum and two-drum tractor-hauled units with both rigid-and oscillating-type frames. Photos illustrate design details and applications.

• • •

TILTING MIXERS—**T. L. Smith Co.**, Milwaukee, Wis. (16 pp., illustrated). Sizes from 28-S to 112-S for heavy-duty concrete mixing in batches up to 4 cu.yd. Tilting drum obviates necessity of lifting materials to discharge batch. End to center mixing action. Pneumatic or hydraulic tilt unit. Design details include anti-friction bearings, adjustable guide rollers, gears running in oil, multiple V-belt drive. New method of front-end charging of batteries of 2, 3 or 4 tilting mixers cuts time and reduces necessary headroom. Tabular specifications.

• • •

GYPSTEEL PLANK—**American Cyanamid & Chemical Corp.**, Structural Gypsum Division, New York, N. Y. (28 pp., illustrated). Factory-cast structural units combining advantages of permanent masonry construction with lightness and insulating qualities of gypsum. Cut, sawed or bored as easily as lumber. Clipped to any type of steel support. Three sizes for various roof and floor spans. Other precast units for short-span roofs, ceilings, beam and girder fireproofing, floor arches, and partitions. Plasters and paints, wallboard and plasterboard.

• • •

MECHANICS' TOOLS—**Bonney Forge & Tool Works**, Allentown, Pa. (56 pp., illustrated). Catalog No. 36 gives list and dealers' net prices, dimensions and materials of socket, construction, structural, engineers', stillson, spanner and special types of wrenches, pliers, hammers, screw drivers, punches, chisels and sets of assorted tools.

now... Glass *won't shatter!*

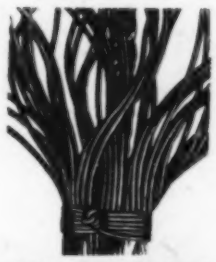
now... Wire rope *won't fly apart!*

● You can hit safety glass with a baseball, but it won't shatter—because it is safety glass. You can remove the seizing from preformed wire rope, but it won't fly apart, "explode" or "broom"—because it has been preformed.

Preforming makes every wire and strand lie in its appointed place, naturally, comfortably, relaxed. Preforming tends to eliminate all internal torsional stress. It resists crankiness and tendency to kink.

Ask us to send you a sample of preformed wire rope. Learn all the facts about the true superiority of preformed rope. For many wire rope applications, preformed rope will give you much greater dollar value.

PREFORMED



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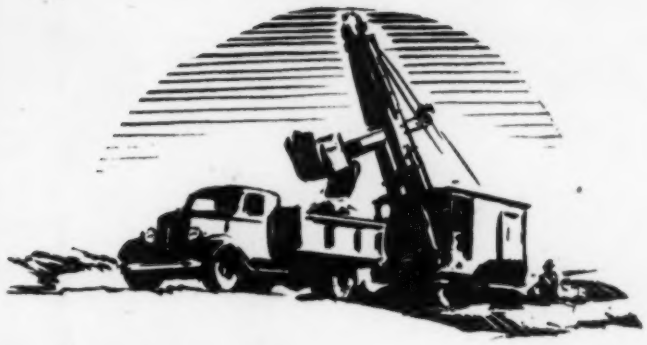
520 North Michigan Avenue • Chicago, Illinois

Preformed WIRE ROPE

for SAFETY · ECONOMY · EFFICIENCY

3 GREAT TIRES FOR DUMP TRUCKS!



Let your work decide your tread.

Any one of these three Goodyear Truck Tires will give you the long, trouble-free service for which Goodyears are famous wherever dump trucks work. Each one has a body of patented Pre-Shrunk Supertwist Cord . . . chemically-toughened rubber . . . blowout protection in *every* ply.

For ordinary all-around dump truck service—where you don't know just what the jobs ahead may be, and if you use high pressure tires — pick the All-Weather Dump Truck Tire (1).

If you're banging over loose rocks, plowing through sharp stone—jobs where cutting and jagging and tread-ripping ruin you—pick the Pneumatic Lug Tire (2).

If you're in sand or sloppy going most of the time—where slipping and spinning and lost traction are costing you money—put on the Sure-Grip (3).

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NEW SMITH 28-S

it's faster!

A brand new compact machine, as modern as television, with the well known Smith dependability, plus many new, but tried and proven features that make for even greater speed and economy . . . New variable speed V-belt drive insuring equal efficiency on either dry or wet batches . . . Extra big diameter narrow drum for faster charging and discharging . . . Full-width renewable drum liners . . . Full-width buckets coated with unusually hard alloy metal for maximum protection and long life . . . Enclosed gear reduction unit running in oil . . . Enclosed power discharge direct connected to countershaft with worm and gear running in oil . . . New self-contained vertical syphon-type water tank . . . Three way, balanced piston-type valve . . . Oversize anti-friction bearings.

Write for new catalog just off the press.

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SMITH MIXERS

THE BOULDER DAM MIXERS

Working against time and zero weather with

LEHIGH EARLY STRENGTH CEMENT

J. &. E. Warm Company, Cincinnati Contractors, met the demand of Joseph E. Seagram & Sons, Inc., for speed in their big expansion program at Lawrenceburg, Ind., by using Lehigh Early Strength Cement. Not only did they provide finished structures many weeks sooner that would have been possible with the use of normal portland cement, but they reduced costs by big savings on heat curing costs in below zero temperatures. 24 hours after pouring foundations and walls, forms were stripped and steel erection begun. In the case of barrel storage rooms, floors were put into service 24 hours after finishing—even while other portions of the structures were still under construction.

Whenever time is the essence in construction, utilize the Plus Values of Lehigh Early Strength Cement. In any weather it makes service strength concrete in a fraction of the time required with normal portland cement. Saves on form costs, overhead, labor and heat curing. Consult the Lehigh Service Department to determine the Plus Values for any specific project.

Look for the Red Arrow

LEHIGH CEMENT

LEHIGH PORTLAND CEMENT COMPANY

Allentown, Pa., Chicago, Ill., Spokane, Wash.

No Diesel can be any better than its FUEL SYSTEM

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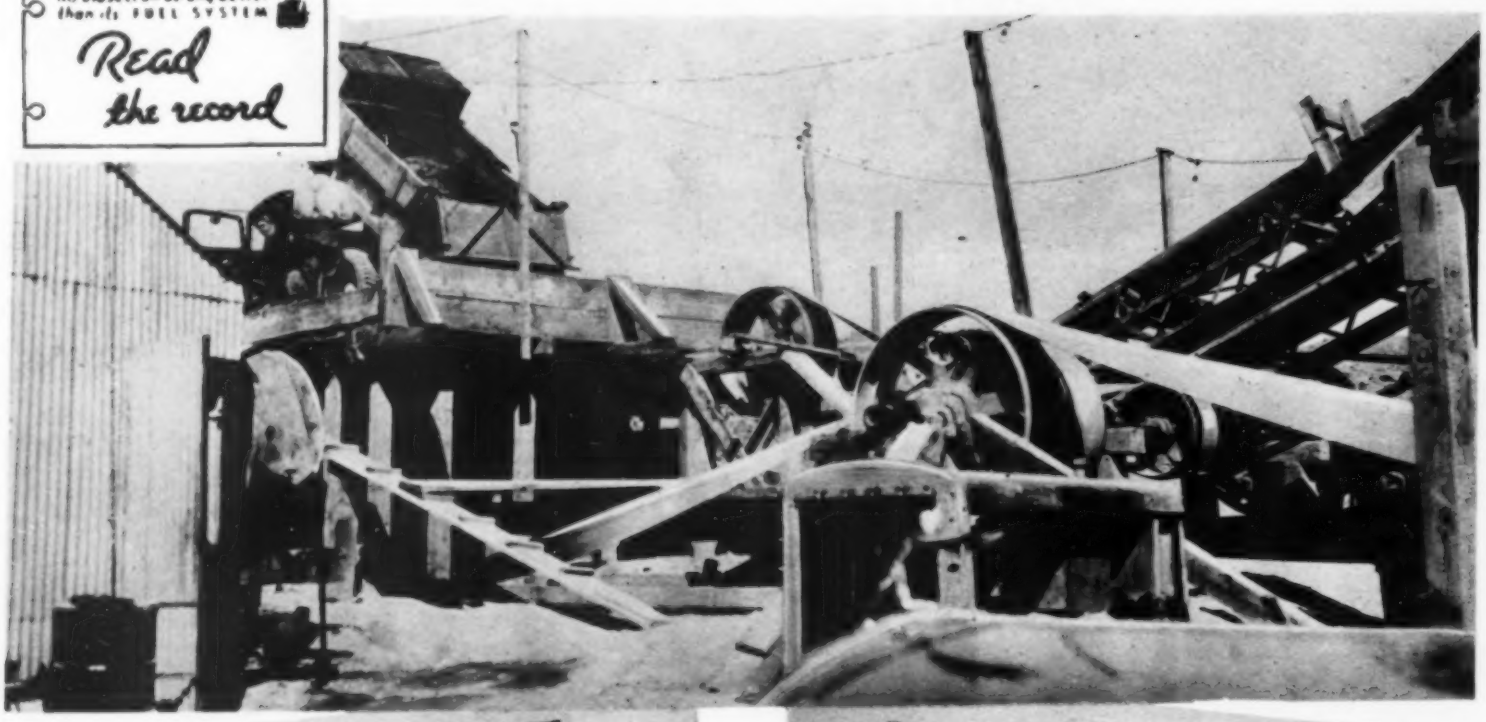

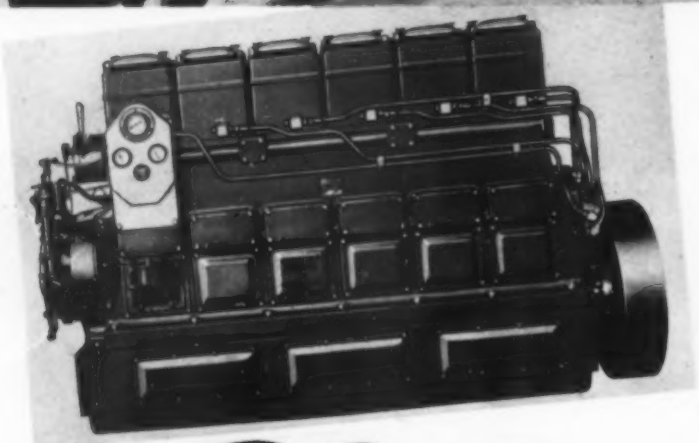

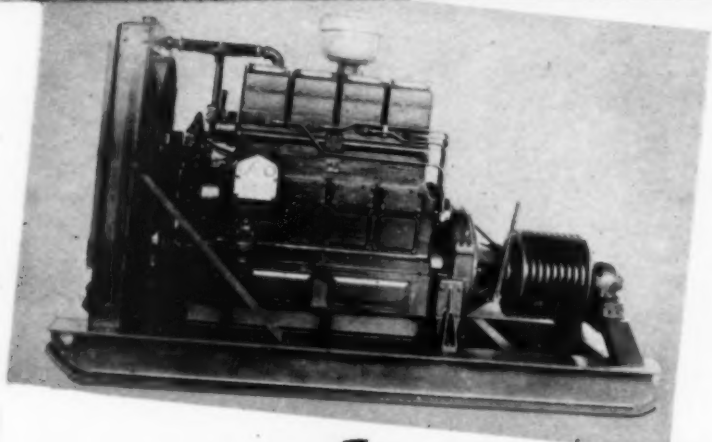

80 tons an hour

● Crushing rock on the job at 80 tons an hour . . . that's what Carl Nyberg is doing with his portable Cummins Diesel-powered outfit.

Mr. Nyberg will tell you that the Cummins Diesel is easier on belts, too . . . because it is smooth-running at all speeds . . . no jerking . . . no excessive pulls or strains on belts or shafting . . . no letting down of power under heavy loads.

Dependability . . . smooth-running . . . fuel economy . . . low maintenance . . . these mean extra profits in the operation of shovels, drag lines, compressors and all types of heavy-duty machinery.

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Users Report Their Results With the Patented Rounded Front AUTOMATIC:—

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"Has increased our production at least 75%. To us, the Page Automatic is the only bucket for dragline work."

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"Last winter we purchased an 8-cy Automatic. It has increased our yardage, enabled us to dig harder burden that we could not dig before."

* ***A gravel plant owner says:***

"This bucket has speeded up our operation. It comes up with a full load when working under 15 feet of water."

*From letters in our files.

Hundreds of AUTOMATIC users in every state and five foreign countries are increasing dragline yardage and profits. Ask them of their results—then see your equipment dealer or write us direct for information on an AUTOMATIC best suited to your machine and job. Bulletin "The AUTOMATIC" gladly sent on request.

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Please send bulletin on the Automatic Dragline Bucket in the_____cu. yd. size

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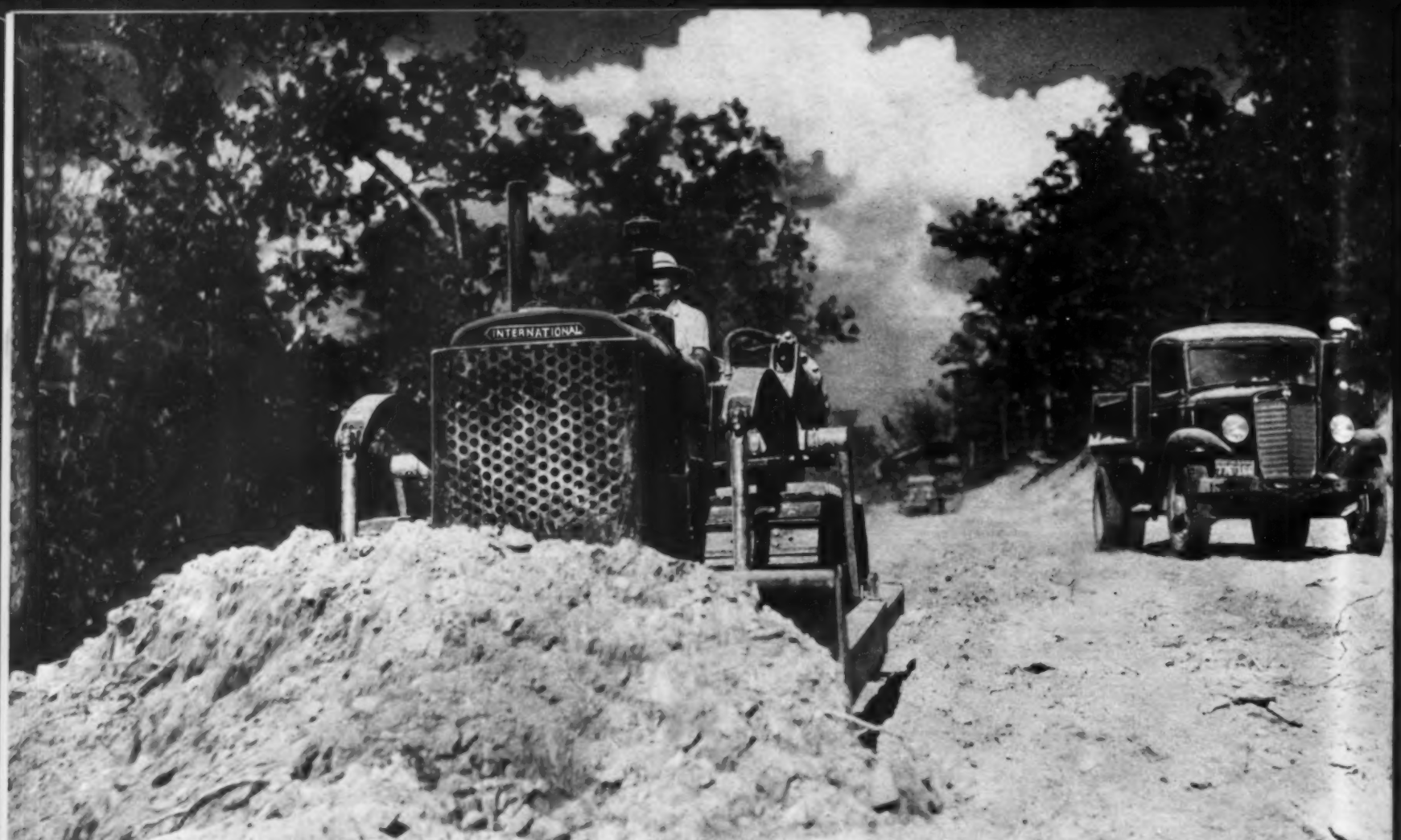

Give the Tough Work to INTERNATIONAL Tractors and Trucks

An International TD-40 Diesel TracTracTor making the dirt move fast on a road project in Arkansas. At the right of the TracTracTor and in the background are International Trucks, favorites throughout the road-building and construction industries.

OPERATORS everywhere are specifying International Tractors, Trucks, and Power Units for the *hard* work because they know from experience that this equipment is built to take it. Sound engineering and quality construction, in every detail, account for the ruggedness and dependability you can expect from Internationals.

Let Internationals solve your own industrial power and hauling problems. International Tractors include both wheel and crawler types, and International Power Units range in size from 12 to 100 h.p., with engines for gasoline or Diesel operation. There is no job too big or too small for International Trucks — the line ranges from the Half-Ton model to the powerful Six-Wheelers.

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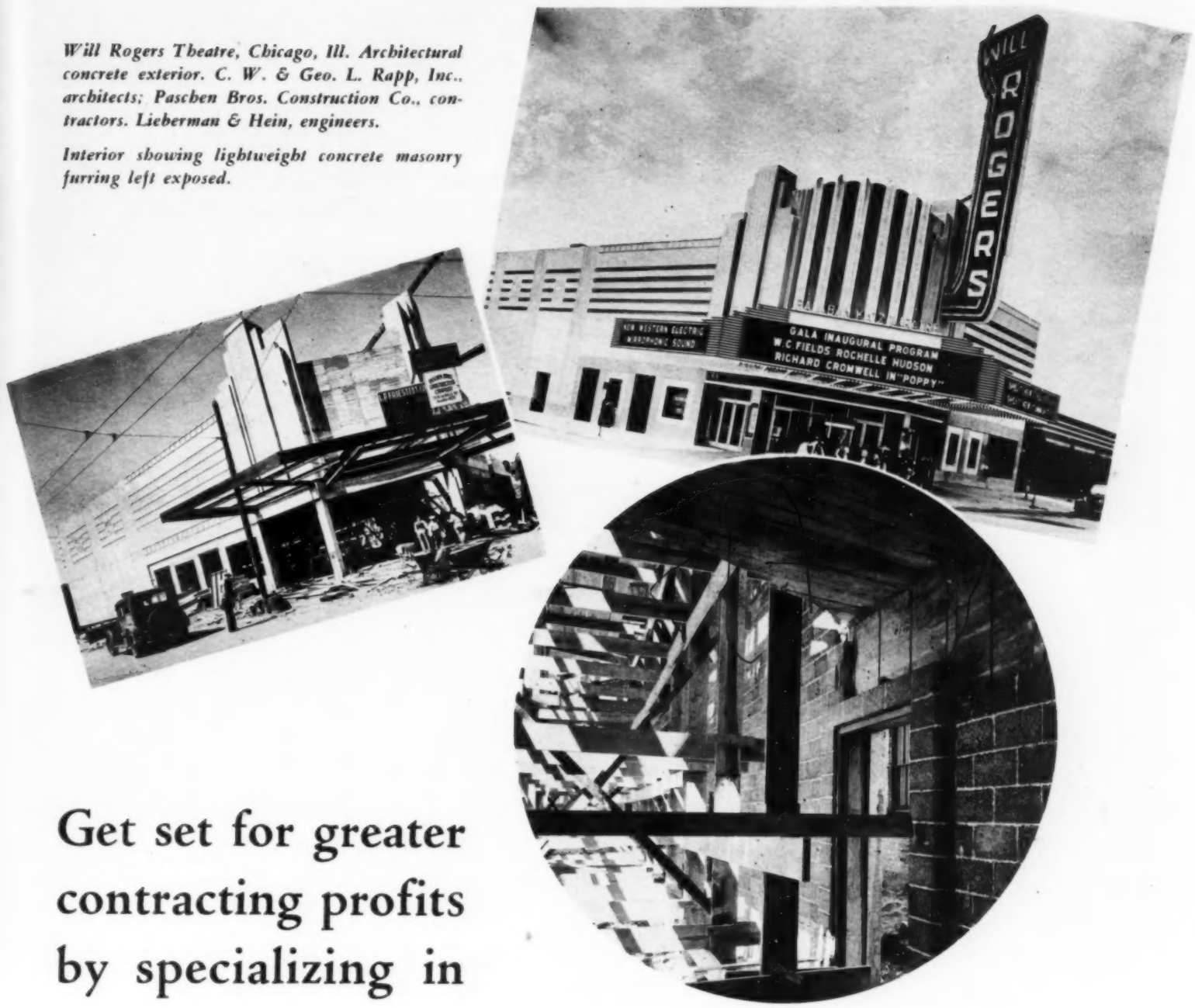
INTERNATIONAL HARVESTER

Will Rogers Theatre, Chicago, Ill. Architectural concrete exterior. C. W. & Geo. L. Rapp, Inc., architects; Paschen Bros. Construction Co., contractors. Lieberman & Hein, engineers.

Interior showing lightweight concrete masonry furring left exposed.



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La Grange Lock

• The cofferdam protects a ten acre area. Moretrench Pumps unwatered this and are shown throwing full streams from the muddy bottom dregs on a twenty-seven foot suction lift. The second operation was to predrain the excavation to a point below the deepest sub-grade — some forty feet down from the surface of the swollen Illinois River.

After that — dry going for the contractor — any place on the lot.

ONE HUNDRED PER CENT MORETRENCH gives prompt results at lowest cost.

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EACH HEAD TURNS TWO DIFFERENT SIZED NUTS • A TIME SAVER

Time and Money Saved with the

FAVORITE

REVERSIBLE RATCHET

WRENCH

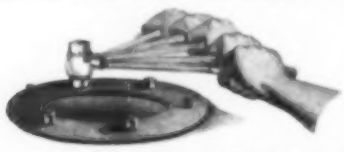
As Each Head Is Double-Ended.

This means there are fewer parts to keep on hand, and less time wasted in changing heads in handle to turn different-sized nuts.

The wrench in illustration turns 1" Hex. nut (bolt size) on one end, and 1⅛" nut on other end.

Opening in head allows bolt to pass clear through.

Reverse Action Instantaneous by Turning Pawl. Wrench can be used in narrow spaces.



Works on a straight-ahead Ratchet Movement. Does not leave nut until operation is completed.

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● The Williams Multiple-Rope Bucket has a DOUBLE HINGE which not only allows a longer spread of the open bucket, but makes for a more rigid construction — greater digging power and speed. *Write for new bulletin.*

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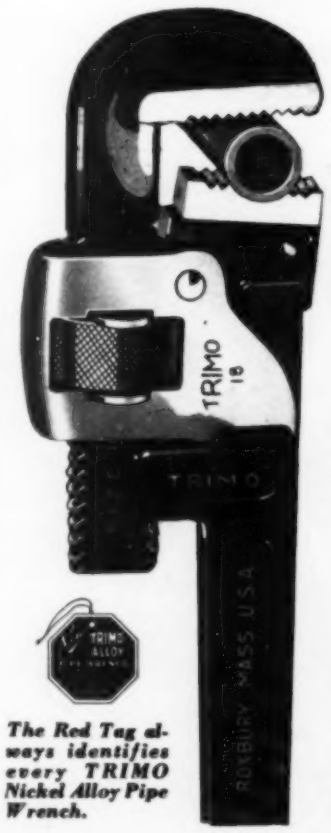
WILLIAMS *Buckets*

POWER-ARM, POWER-WHEEL
MULTIPLE-ROPE, DRAGLINE

★ TRIMO ★



The Red Tag always identifies every TRIMO Nickel Alloy Pipe Wrench.

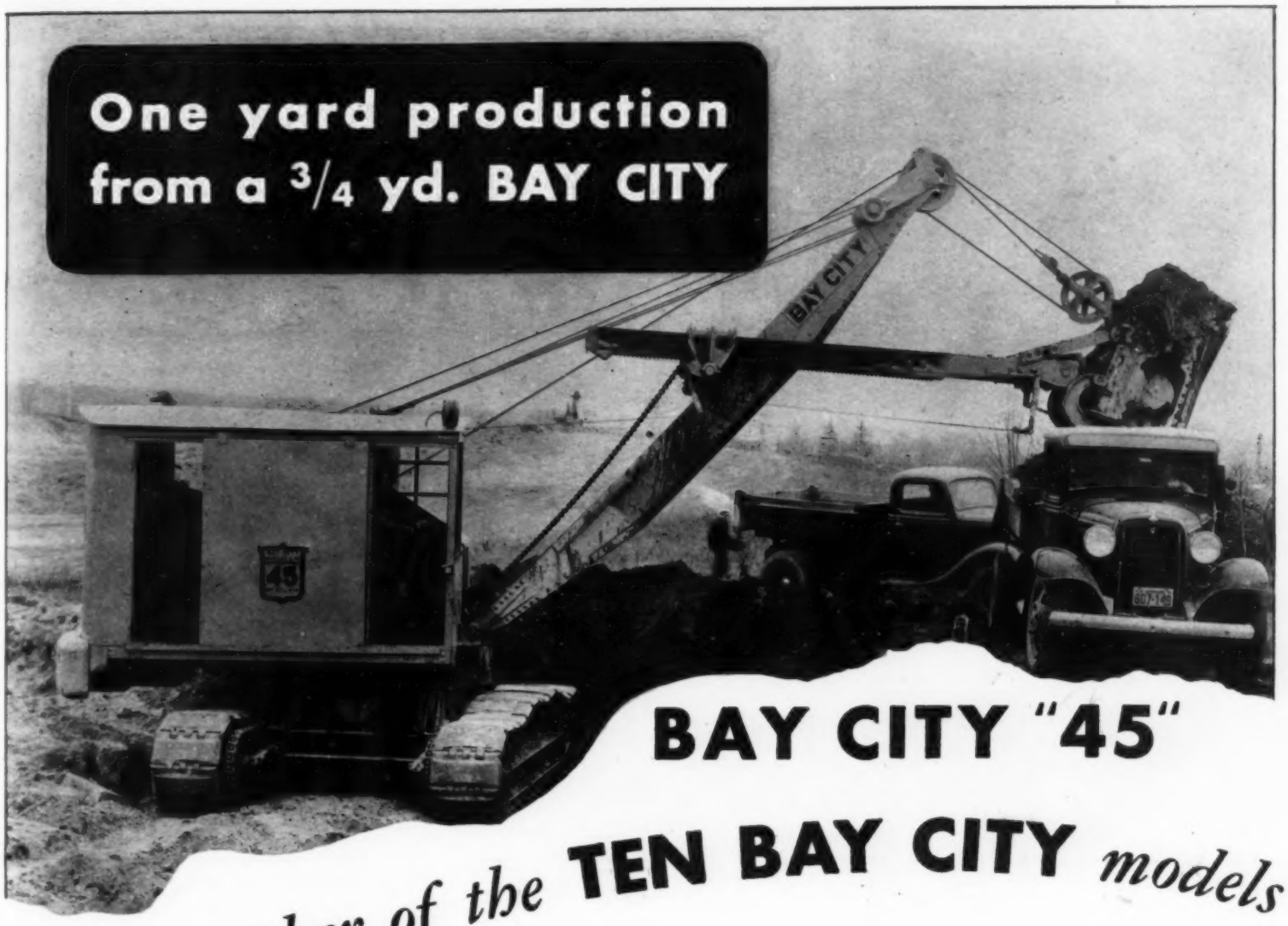
Drop Forged

CHROME MOLYBDENUM NICKEL ALLOY STEEL

That's the steel we make TRIMO Wrenches of. That's the reason why TRIMO Wrenches are safer and cost less to use.

Buy TRIMO Wrenches for your jobs. Save money with these quality wrenches. Nothing can touch them for all-around efficiency, economy and safety.

TRIMONT MFG. CO., INC.
Roxbury (Boston), Mass.



BAY CITY "45"

Just another of the TEN BAY CITY *models*

25 REASONS FOR CHOOSING BAY CITY

1 — Convenient economical weight.
2 — Helical cut gears — noiseless, long wearing.
3 — Unit (nickel-manganese) car body and machinery table, totally heat treated.
4 — Frictionless bearings thruout.
5 — 6-cylinder power.
6 — Extra large diameter swing roller-path.
7 — Oversized clutches & brakes.
8 — Drop forged crawler shoes.
9 — Long crawlers — low bearing pressure.
10 — Chain crowd with automatic adjustment.
11 — Swing lock — in any cab position.
12 — Automatic Travel lock.
13 — Extra heavy cab. Plenty inside working room.
14 — Fast operating speeds.
15 — Two travel speeds.
16 — All steel construction.
17 — Three lever control.
18 — E-Z clutch control.
19 — High pressure lubrication thruout.
20 — Safety worm boom hoist.
21 — Separate hoist drums.
22 — Internal swing teeth.
23 — Unequalled steering at full speed.
24 — Convertible — without machinery change.
25 — Accessibility for inspection or adjustment.

The contractor on this job is using a 3/4 yard BAY CITY, working weight 45,000 lbs. Yet by "heaping" the bucket load he's been consistently turning out yardage matching one-yard machine production . . . no wonder he's enthusiastic over the performance of his BAY CITY investment.

Every BAY CITY owner is *enthusiastic*

and they spread the news. They brag of the *plus performance* of their outfits —the efficiency and the economy they achieve, more so than any other shovel they ever owned. And they are a great and constantly growing class of *repeat* buyers, buying on the basis of BAY CITY *performance*. No wonder BAY CITY is enjoying the biggest sales volume in our history, in *all classes* of BAY CITY Shovels. No wonder we are proud of the proved ability of all our shovels, their speed, their power, their endurance. If you let us, we will be glad to refer you to users and let them tell the story that will convince you of BAY CITY superiority.

10 Models — 3/4 yd to 1 1/4 yd.

Sensibly designed — honestly advertised — Fairly and moderately priced.

BAY CITY SHOVELS Inc. Eastern Offices, Roselle, N. J. **BAY CITY, MICH.**

Investigate Blaw-Knox TRUKMIXERS

We would like to tell you why Blaw-Knox TRUKMIXERS and Agitators not only produce *better concrete*—but save you money in low depreciation and maintenance costs.

You should know about the mixing blade arrangement and the faster, superior mixing action; the accurate water control, and the fine points of engineering and construction which make the Blaw-Knox Trukmixer a dependable unit for uninterrupted service.

Investigate Blaw-Knox Trukmixers.

BLAW-KNOX COMPANY
2086 FARMERS BANK BUILDING
PITTSBURGH, PA.
NEW YORK · CHICAGO · PHILADELPHIA · BIRMINGHAM
Representatives in Principal Cities

"THE BEST MACHINERY WE EVER USED"
— L. H. Bolduc Co., Minneapolis

Sterling CONTRACTORS EQUIPMENT

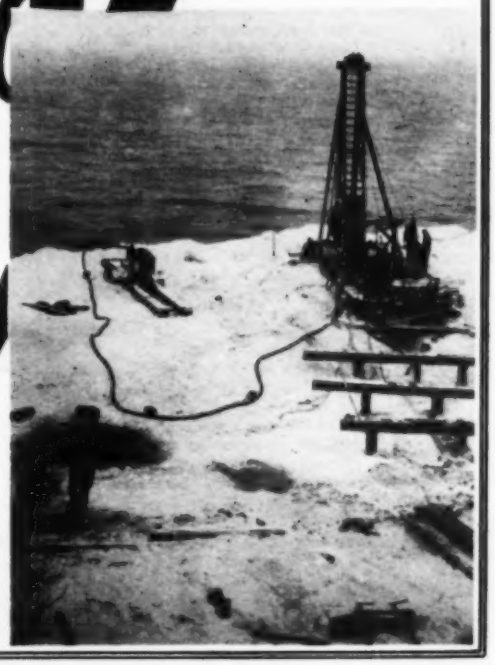
Read What Mr. Bolduc has to say

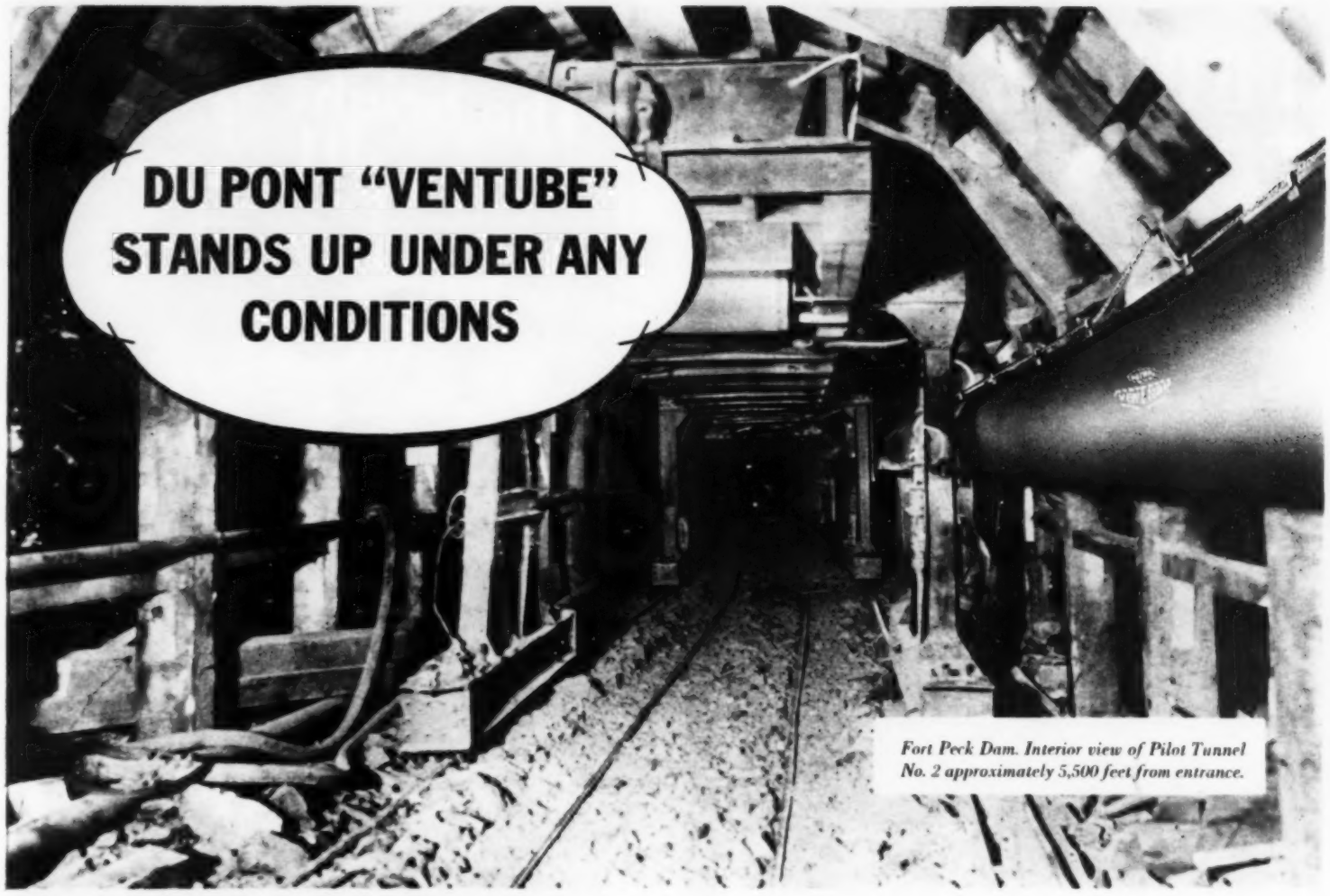
"We found the 35-40 H.P. gasoline Hoist to be very satisfactory. We also found the Gas-Jet Pump to be a knockout. Our experience in pile driving covers a period of 35 years and we are glad to state that this pump is the best piece of machinery that we have ever used. For your information, the water was lifted 10 feet to the pump and carried from that point 200 feet through a 3" high pressure water hose and discharged through an inch nozzle giving us a pressure of about 140 pounds which was sufficient to wash our pile right down without a blow of the hammer to a depth of 20 feet or more." — Leroy A. Bolduc, L. H. Bolduc & Co., Minneapolis, Minn.

Write today for illustrated literature and prices.

Sterling
MACHINERY CORPORATION
411-13 Southwest Blvd. Kansas City, Mo.

Below—The White Fish Point Michigan job Bolduc finished in December, 1936 — Note Hoist and Single Stage Gasoline Engine Driven Jetting Pump





Fort Peck Dam. Interior view of Pilot Tunnel No. 2 approximately 5,500 feet from entrance.

AND – IT SAVES TIME AND MONEY IN TUNNEL DRIVING

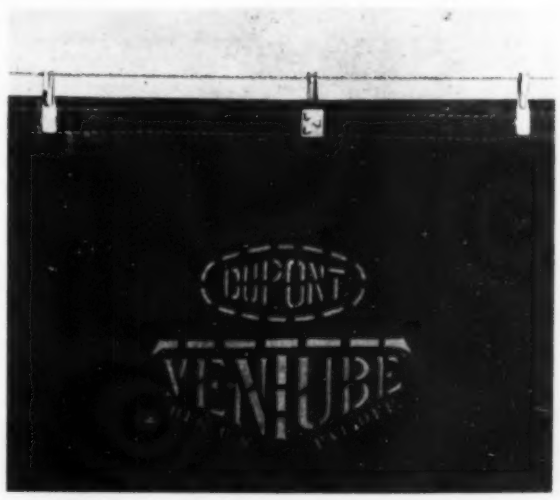
THERE are several good reasons why Jute "Ventube" is considered the finest, toughest flexible ventilating duct on the market.

First, it's made of extra-heavy, long-fibered Hessian cloth impregnated with rubber by a process that makes this kind of flexible ventilating duct the strongest you've ever seen. Then, Jute "Ventube" is just as strong in tear resistance in the warp direction as it is in the filler. When a duct is strong in one direction and weak in the other, it will burst along the lines of least resistance. That's why rips sometimes extend for half the length of a section of tubing.

It is significant that where world's records in tunneling operations have been set, du Pont "Ventube" has been used. "Ventube" is hung from support wires quickly strung. It is rapidly withdrawn from the working face when blasting, and it saves more time by the rapidity with which it can be thrown up to the working face after blasting to exhaust gases and permit a quicker return to work by the shift.

These time-saving qualities of du Pont "Ventube" mean real savings in labor cost.

The best way to convince yourself of the strength and ease of handling of Jute "Ventube" is to install a half dozen sections leading up to the working face so you can observe it under actual tunneling conditions.



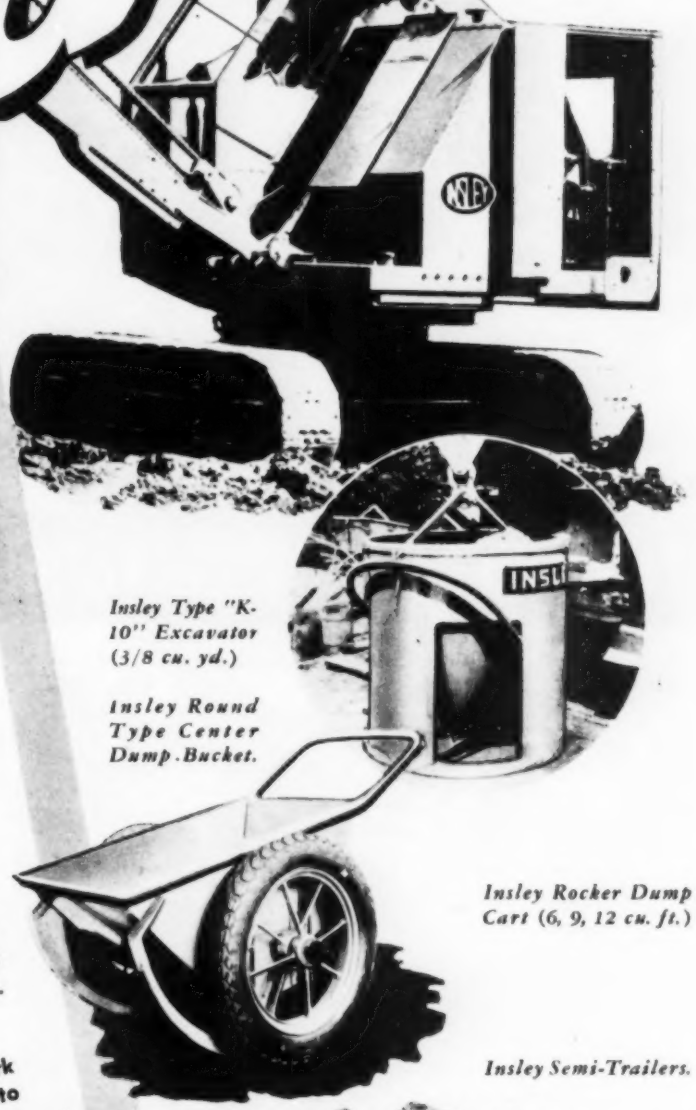
This special method of suspension is a real time-saver.

DU PONT
VENTUBE

The Flexible Ventilating Duct

E. I. DU PONT DE NEMOURS & CO., INC., *Fabrikoid Division*, Fairfield, Connecticut

Time Savers



- **Insley Type "K-10" (3/8 cu. yd.) Excavator**
  Each crawler has independent Jaw Clutch and Friction Brake . . . swinging speed 5 r.p.m. . . . powered by a 45 h.p. 6-cylinder gasoline motor.
- **Insley Round Type Center Dump Bucket**
  For placing small or large masses in forms or foundations . . . Positive Control at any stage of dumping . . . Round Apron gives continuous ground support.
- **Insley Semi-Trailers**
  Are moving twice as much dirt on most jobs as comparable equipment . . . more yards per load . . . more trips per day due to the quick action in both dumping and closing . . . saves wear and tear on trucks.
- **Insley Rocker Dump Carts (6, 9, 12 cu. ft.)**
  Exclusive ROCKER CONSTRUCTION assures a clean dump . . . prevents cart from rolling while in dumping position . . . Pneumatic Tires . . . Roller Bearings . . . It's easy to push.

Insley Type "K-10" Excavator (3/8 cu. yd.)

Insley Round Type Center Dump Bucket.

Insley Rocker Dump Cart (6, 9, 12 cu. ft.)

Insley Semi-Trailers.

When it means INCREASED output per work day, at LESS COST it is sound business to check the economy and performance of these INSLEY time-savers.

INSLEY MANUFACTURING CORP.
INDIANAPOLIS, INDIANA

INSLEY

GREATEST OBTAINABLE TRACTION

for excavation and oil field trucking, road machinery and all other heavy off-the-road work

THE NEW GENERAL HEAVY DUTY CLEATED TRACTOR TIRE

1. Deep cut "Chevron" tread is practically slip-proof in soft going.
2. Tread is self-cleaning in mud and sand.
3. Center riding rib, for smooth rolling and slow wear when running on hard surfaced roads.
4. Stronger, because of two extra plies running from bead to bead.
5. Cooler running due to patented *no-breaker-strip construction.*
6. Heavy dual and triple-cable beads.

No matter what your job, there is a General Tire that will do it better at lower cost. Dependable Generals are proving this to skeptical "show me" operators every day.

Your General Tire dealer has a complete, specialized line of truck tires. He is a practical truck tire man with wide experience and knowledge. He can save you money. Call him in.

THE GENERAL TIRE & RUBBER CO. • AKRON, OHIO

In Canada—The General Tire & Rubber Co. of Canada, Ltd., Toronto, Ont.

GENERAL

TRUCK TIRES

and stacks earth alongside canal. Link-Belt installation, powered by electric motors, is loaded by 2½-yd. draglines.

THE MAN WHO REALLY KNOWS CONSTRUCTI

you'll find field pictures like these in every issue of

CONSTRUCTION Methods and Equipment

TWIN MIXERS

STEEP-ANGLE BOOM of paving mixer equipped with speci . bucket for yer placement of concrete serves U.S. Engineer Department in building walls of Alhan Wash storm drain in Los Angeles County, Calif., under direction of U.S. Engi Office, Los Angeles District. Mixer moves back and forth along wall to main plastic concrete in monolithic section at uniform level. Batch trucks haul aggre from central plant. Boom and bucket rig is known as "Monkey

TRAILER GETS A

CTON EQUIPMENT IS THE MAN WHO USES IT

DUMP
1-yd.
s con-
imber
les of
tank
eek.

tons.

OLLOWING COMPLETION of 20-ft. strip of concrete base, single pave
slab places adjacent 10-ft. lane. Drainage pipe is stacked on bank.
finisher strikes off concrete.

30-ft. wide, served a crew of four droppe
brick on the slag

ELECTRIC-POWERED SHOVEL with 2½-yd. dipper loads rock from foundation excavation at Wheeler dam into trucks.

ETS A

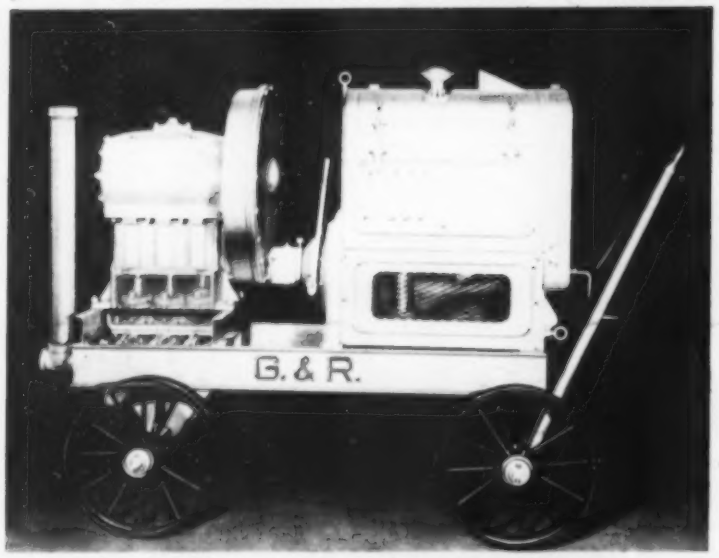
If it's the man out in the field, the man who gets the job done, who has the real low-down on equipment. If he is using your equipment make certain that he stays sold on it. If he isn't using it show him through the advertising pages of *CONSTRUCTION Methods and Equipment* what he's missing. His superiors take a lot of stock in what he has to say about the tools they give him to turn out the job on time and at a profit.

No one really knows the limits of his influence but this fact is certain . . . he knows equipment. He has to, else he would find it a waste of time and money having *CONSTRUCTION Methods and Equipment* come to him every month.

***CONSTRUCTION Methods and Equipment* is published by McGraw-Hill, 330 West 42nd Street, New York, N. Y.**

G & R Triplex Road PUMPS

Modern-Efficient DESIGNED FOR 1937 CONCRETE ROAD BUILDING



LARGE VOLUME AT HIGH PRESSURE

No need to skimp on water when you have a G & R Triplex on the job. Large volume at high pressure puts water where you need it at a big saving in piping costs. Here is the pump designed for 1937 road building.

NEVER AIR BOUND

Automatic Air Release now eliminates the bother of opening pet cocks by hand to release the air that every road pump picks up with the water. Your G & R Triplex is always delivering its full capacity to the job.

FULLY ENCLOSED — SELF OILING

All working parts of the pump are fully enclosed and deluged with oil. Simply fill the crankcase with oil. No hand oiling of any parts required.

PLUNGERS NOT DAMAGED BY SEDIMENT

Since the water end of the pump is below the pump body, any sediment in the water passes through the pump without having a chance to lodge in the plunger packing — a big advantage, assuring long plunger life.

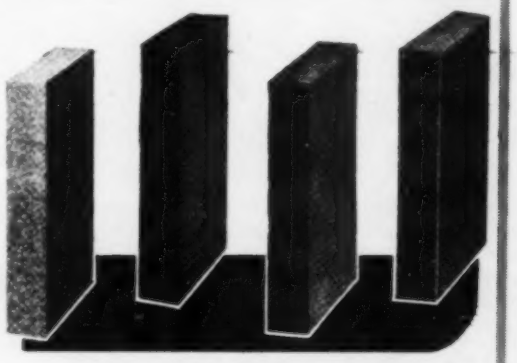
BUILT FOR LONG, HARD SERVICE

Liberal use of Molybdenum alloy heat treat steel and oversize bearing, combine with the rugged design of G & R Triplex Pumps to assure long years of trouble free service. Be sure you know what you get in a Road Pump — compare them all with the G & R.

Get all the information on G & R Pumps before you buy any pump this year. They are the most dependable pumps at the lowest price.

THE GORMAN-RUPP CO., Mansfield, Ohio

EXPANSION JOINTS FOR HIGHWAY CONSTRUCTION BY



SERVICISED! Servicised

Years and years of service on tough jobs has proved that you are justified in specifying SERVICISED PRODUCTS. Whether it be Expansion Joints — Asphalt Planking — or Industrial Flooring you'll get the accepted standard — not always lowest in first cost — but always first in *Quality* — that's SERVICISED. Send our engineering department details of your special requirements or ask for special bulletins on products you are interested in, now.

Servicised Products Corp.
6058 W. 65th ST. CHICAGO, ILL.

HAISS EXCAVATOR

For **UNDERPASS, SUBWAY, ALLEY AND OTHER CLOSE QUARTER WORK** *because it digs and loads in a straight line.*

For **SHALLOW GRADING AND LIGHT EXCAVATING** *because of high work capacity without heavy investment.*

Handles any boulder-free material into which a workman can drive a pick. Bucket capacity — 2½ yds. per minute. Built to prove so efficient you'll want to own another. *Bulletin* 530.

GEORGE HAISS MFG. CO. INC., 139th St. & Canal Pl., New York

Representatives in all Principal Cities

ASK FOR BULLETIN 331 ON FAMOUS HI-POWER CLAMSHELL BUCKETS

AS A *Chicago* HOUSING PROJECT *Went Moto-Mix*

Chicago, the last big city in the land without ready-mixed concrete, went Rex Moto-Mixer in placing the concrete on Trumbull Park homes, Housing Project H-1408.

The George A. Fuller Co. had used Rex Moto-Mixers on a housing project in another city. They bought more Rex Moto-Mixers and brought the entire fleet to Chicago for the Trumbull Park job.

They had learned how well it paid to forget the old stuff.

36,000 yards of concrete, placed in two- and three-story units scattered over an area one-quarter of a mile wide and one-half mile long, are being placed by Rex Moto-Mixers.

In 1937, before you buy, before you bid, forget the old stuff. Investigate the up-to-date methods of handling concrete.

REX READY-MIXED CONCRETE

Send today for a copy of the book—"Rex Moto-Mixers and Agitators." It describes the 1937 way to secure a better margin on this modern, profitable method of selling cement and aggregates. It illustrates the 1937 Rex Moto-Mixer features.

CHAIN BELT COMPANY
1664 W. Bruce Street Milwaukee, Wis.

REX The Up-to-date Method of Handling Concrete

Moto-Mixers

CHAIN BELT COMPANY *of Milwaukee*

Every Cartridge a Primer Cartridge..

WHEN YOU LOAD WITH CORDEAU

Loading well drilled holes with Cordeau-Bickford Detonating Fuse. Inland Lime and Stone Co., Manistique, Mich.

THIS is one of the Cordeau features that have made the giant blast not only possible but highly profitable. The Inland Lime and Stone Company has found this to be the case — in fact they are credited with some of the largest blasts on record.

Cordeau-Bickford is an insensitive detonating fuse. Since each cartridge goes with the force of a primer cartridge, greater tonnage and easier mucking result. Split second rotation in a planned Cordeau hook-up allows relief of burden. Loading is accomplished with less danger to the men. These advantages all result in lower operating costs — greater efficiency.

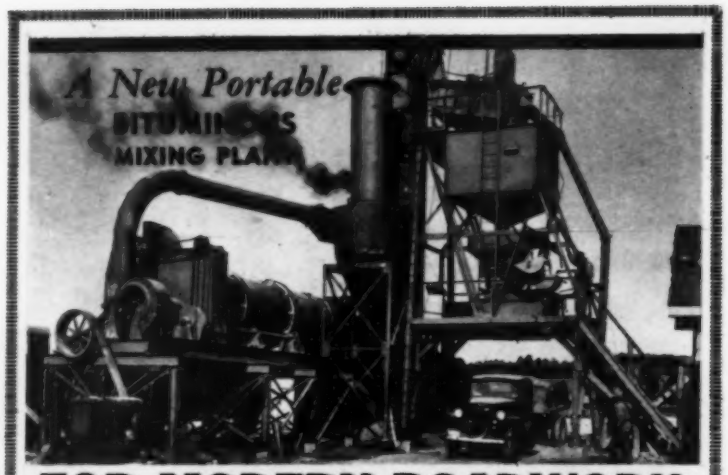
Remember, Cordeau-Bickford Detonating Fuse is manufactured with the same precision that has made Ensign-Bickford Safety Fuse famous for its dependability since 1836. Write for the Cordeau book—it's free.

CORDEAU-BICKFORD DETONATING FUSE

THE ENSIGN-BICKFORD COMPANY, SIMSBURY, CONN.

MAKERS OF ENSIGN-BICKFORD SAFETY FUSE SINCE 1836

CB41



FOR MODERN ROADWORK

...at Low Cost

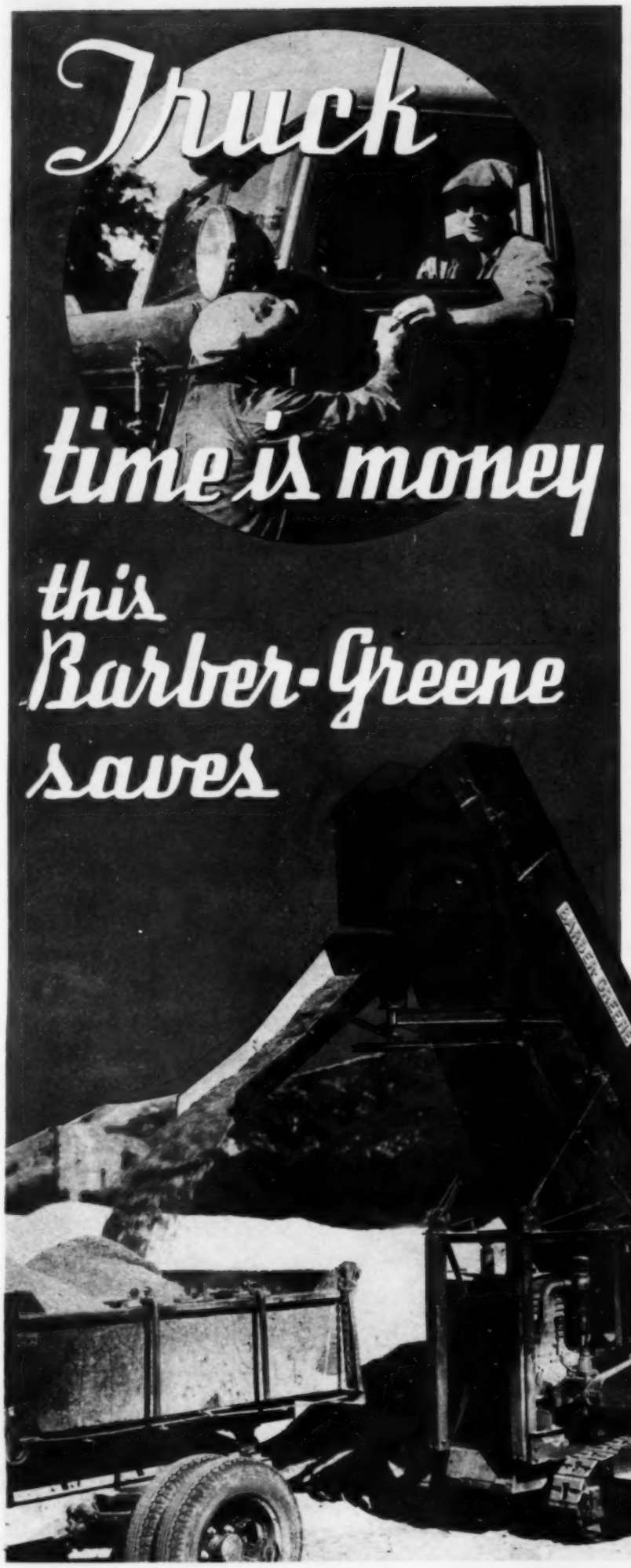
This plant was designed to meet the demand for the economical improvement of secondary roads. We have built several to date and they have proved their worth in actual service. No investment is needed for a running gear, plant adapted to standard flat bed truck and trailer hauling.

Some Details

- Can be erected by 3 or 4 men in a few days.
- No erection equipment required. Plant equipped with hoist and jib crane.
- Built in 2 units (dryer unit; and screening and mixing unit).
- Comply with most highway loading and clearance regulations.
- SKF bearings throughout. Fully enclosed vibrating screen. Steam-jacketed, steam-operated steel mixer. Large combustion chamber and dust collector.
- Write for Bulletin T-250.

HETHERINGTON & BERNER, INC.

701-745 Kentucky Avenue — Indianapolis, Ind.



IF you haven't carefully checked your itemized costs, you'll probably find "Truck Time" one of the biggest leaks in your job system.

Barber-Greene Model 82 Loaders have often made it possible to reduce the number of trucks. On other jobs truck time savings paid for the loader before the job was half done. A loader that's rated at 2 to 3 yards a minute—has been clocked at 4—doesn't take long to load your biggest truck—can't cause appreciable truck waiting.

Consider your present loading system from this important angle—and then consider the many superior features of this Barber-Greene Loader: Synchronized Feeding, Tank Type Chassis Frame, Automatic Overload Release, Super Maneuvering, Slow Crowding, Parallelogram Oscillating Axle, and many others.

A card will bring complete details—there is no obligation.

36-31

BARBER GREENE

BARBER-GREENE COMPANY

530 West Park Ave., Aurora, Ill.

STANDARDIZED MATERIAL HANDLING MACHINES

KOPPE

AN IMPORTANT SUPPLIER TO THE PUBLI

You have probably used some product or material from some Koppers company or Koppers affiliate. We would like you to know *all* Koppers products which serve the public works field, and to know that you can depend on the same quality and service from each one of them—whether it be road tar, roofing, waterproofing waterworks equipment, incinerators, gas holders, paint, fire hydrants, treated timber, piston rings, or any of the rest. Any sales representative from any Koppers division or subsidiary will be glad to give or get for you any information you desire.

KOPPERS COMPANY, PITTSBURGH, PA.

TARMAC USED IN SOIL STABILIZATION—Millions of gallons of Koppers Tarmac have been used yearly in the construction, maintenance and repair of streets and highways. In the past several years, Koppers has pioneered in soil stabilization with Tarmac. Stabilized roads now in successful service for some time indicate that this method of construction will revolutionize road building.

THIS PLANT IS EXPECTED TO SAVE CITY OF PROVIDENCE $100,000.00 A YEAR—Garbage burned in this incinerator at Providence, R.I. (a new type just built by a Koppers subsidiary, the Hiler Engineering and Construction Company) generates all power requirements of the incinerator plant, as well as the sewage disposal plant and sewage pumping station.

KOPPERS COAL PROVIDES THE POWER FOR MANY PUBLIC WORKS—Koppers is one of the principal coal producers in this country.

KOPPERS PUBLISHES HANDBOOK ON TAR ROAD CONSTRUCTION—Send for a copy of the Tarmac Handbook. Use the coupon at the right.

KOPPERS PRODUCES CREOSOTE, TREATS TIMBER WITH CREOSOTE BY THE PRESSURE METHOD, AND MAKES PAINT FOR CREOSOTED SURFACES—The protection of timber against decay, termites and marine borers has been a constant subject of technical study by Koppers. The Tar and Chemical Division is one of the largest producers of creosote. The Wood Preserving Corporation treats great quantities of timber by the pressure method for guard rails, posts, poles, bridges, culverts and other uses. The Tar and Chemical Division has developed Lumino, a bituminous base paint which produces a bright aluminum color on creosoted wood.

ERS

WORKS FIELD

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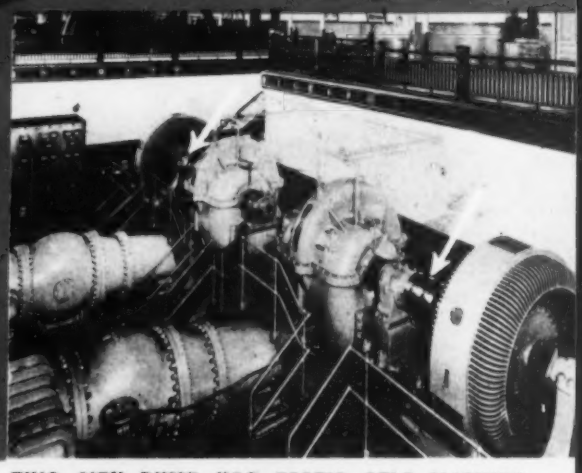
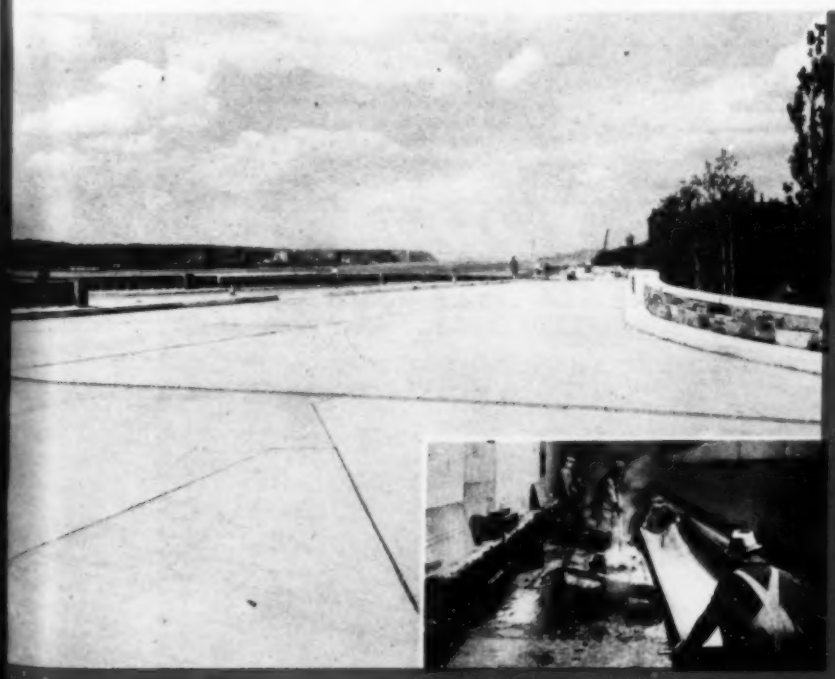
THE WOOD PRESERVING CORPORATION
WESTERN GAS DIVISION
BARTLETT HAYWARD DIVISION
HILER ENGINEERING AND CONSTRUCTION COMPANY
AMERICAN HAMMERED PISTON RING DIVISION
THE KOPPERS COAL COMPANY
THE MARYLAND DRYDOCK COMPANY
THE WHITE TAR COMPANY OF NEW JERSEY, INC.

THE STEM THREADS ON THESE FIRE HYDRANTS WILL NOT CORRODE OR FREEZE—The "Western" Hydrant (built by Koppers, Western Gas Division) has the operating unit removed from the water zone, and provision is made for lubrication of the operating elements. If the hydrant is broken, the compression type valve is held against its seat by the water pressure, and flooding is prevented.

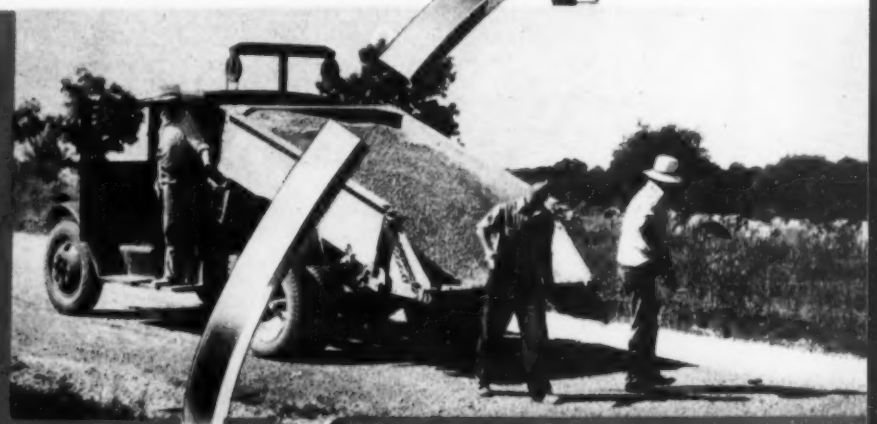
CASTS TUNNEL LINERS—In its Bartlett Hayward plant at Baltimore, Koppers makes huge cast iron rings, as shown in this photograph for tunnel liners. (Man in foreground indicates size of this liner.)



THIS CITY PUMP HAS FAST'S SELF-ALIGNING COUPLINGS—These Fast's Couplings, as manufactured exclusively by the Bartlett Hayward Division of Koppers, are all-metal, lubricated couplings of the double engagement type. They have eliminated troublesome operating conditions in many plants. This photo was taken in the City of Detroit Pumping Station.



734,000 SQ. FEET OF KOPPERS WATERPROOFING USED ON THE NEW YORK CENTRAL WEST SIDE HIGHWAY, NEW YORK—Koppers Coal Tar Pitch Waterproofing can add years of life to hundreds of concrete and masonry structures . . . bridges, piers, foundations, retaining walls, etc. Send for waterproofing specifications. (Inset shows Koppers Membrane Waterproofing being applied).



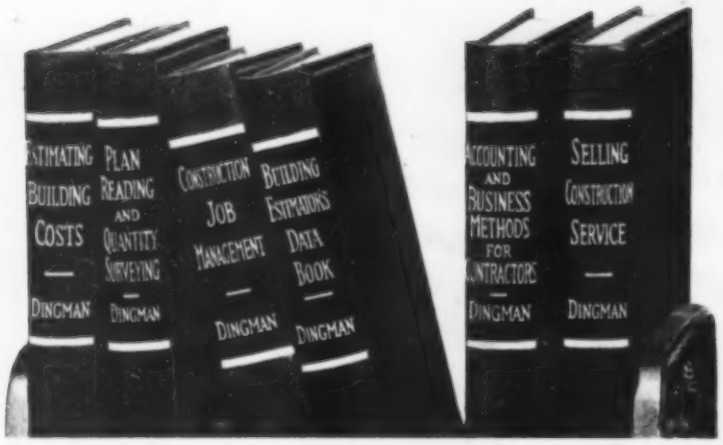
CARRIES 10,000,000 PISTON RINGS IN STOCK—The American Hammered Piston Ring Division of Koppers produces more types and sizes of piston rings than any other company. Every type of piston ring used in transportation equipment used in public works construction projects can be obtained here, including rings for heavy-duty

CM-2

KOPPERS COMPANY, Pittsburgh, Pa.
Please send me information on:

- ☐ Coal
- ☐ Coal Tar Roofing
- ☐ Creosote
- ☐ Dampproofing
- ☐ Disinfectants
- ☐ Insecticides
- ☐ Fast's Couplings
- ☐ Fire Hydrants
- ☐ Gas Holders
- ☐ Municipal Incinerators
- ☐ Pipe
- ☐ Piston Rings
- ☐ Sewage Disposal Equipment
- ☐ Signal Buoys
- ☐ Sluice Gates
- ☐ Tanks
- ☐ Tarmac Road Tars
- ☐ Tarmac Handbook
- ☐ Treated Timber
- ☐ Tunnel Liners
- ☐ Waterproofing
- ☐ Waterworks Gate Valves
- ☐ Weed Killers

NAME..... ADDRESS.....



Practical facts on every phase of building construction!

HERE is a Library of books that are packed to the covers with the best plans and methods for speeding up production, saving materials and labor, and cutting costs. These six books cover every phase of practical construction work from estimating building costs to the selling of construction service—from plan reading and quantity surveying to practical job management. With the aid of these books the contractor can get business in these dull times by learning how to make savings, and through them being able to make lower bids. The construction superintendent can learn how to keep costs down, which insures his job these days.

The Dingman Building Contractors' Library

The Dingman books have won a wide reputation among builders and building contractors for their sound, practical and easy-to-understand discussion of building construction work. All of the material has been drawn from actual practice.

This library is intended for

[1] The building contractor who wants a handy reference set that will give him almost instantly a ready answer to most of the problems that come up in the course of the day's work.

[2] The young men in the building industry who intend to make the business of construction their life work, and who want the kind of guidance that will aid them to climb to the top.

[3] Everyone in the building industry who wants to keep his job by increasing his usefulness and efficiency.

Each one of the volumes in this set is a complete handbook on some important subject. Sturdily bound and pocket size, it will go right "on the job" with you for immediate consultation.

Practical data is given on analyzing a construction job into its component parts—estimating the costs of labor, haulage, equipment, materials, etc.—plan reading and determining quantities from specifications—personnel management—successful supervision of every building operation—efficient and economical business methods—office procedure such as accounting banking, purchasing, etc.—advertising and selling methods for contracting service—and a complete data book of tables, forms and calculations most frequently used by the builder.

Free Examination—Small monthly payments

Without a cent of expense—without any obligation on your part—you may examine the Dingman Building Contractors' Library for 10 days and determine its value for yourself. Try the books out on your everyday problems—make them prove their worth to you. Unless they meet every test send them back at our expense. If the books prove satisfactory and you decide to keep them, pay only $1.50 in ten days and then $2.00 a month for six months.

Every contractor and builder, every architect and engineer, every student and executive, who is seeking practical help on the everyday problems connected with building construction work should have this valuable reference library.

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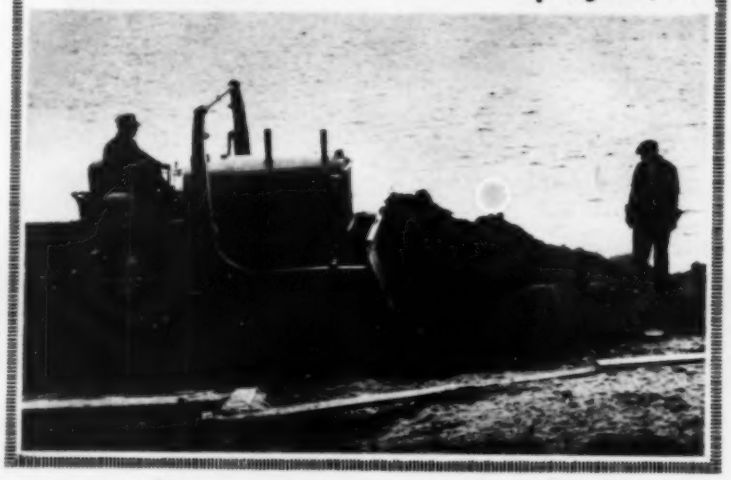

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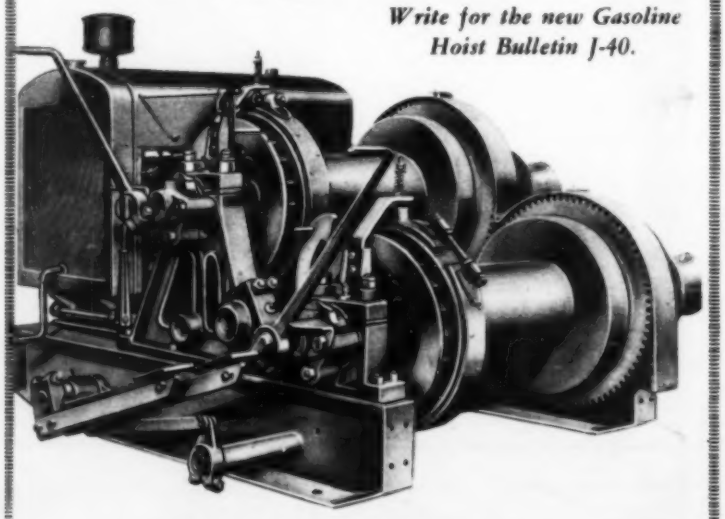

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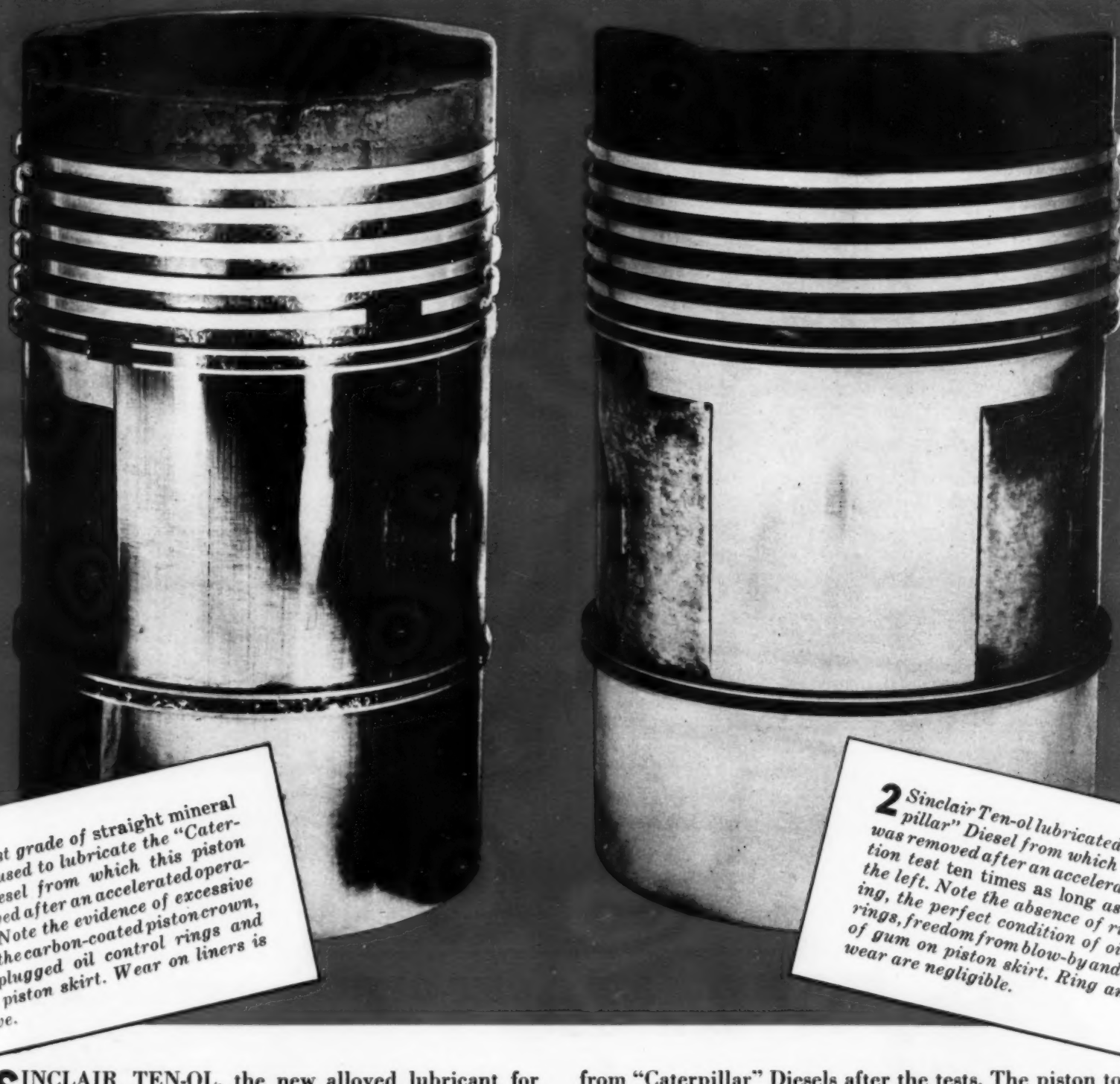

1 *The finest grade of straight mineral oil was used to lubricate the "Caterpillar" Diesel from which this piston was removed after an accelerated operation test. Note the evidence of excessive blow-by, the carbon-coated piston crown, sludge, plugged oil control rings and gum on piston skirt. Wear on liners is excessive.*

2 *Sinclair Ten-ol lubricated the "Caterpillar" Diesel from which this piston was removed after an accelerated operation test ten times as long as No. 1 on the left. Note the absence of ring-sticking, the perfect condition of oil control rings, freedom from blow-by and absence of gum on piston skirt. Ring and liner wear are negligible.*

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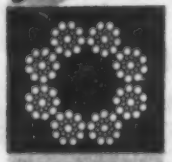

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